BROOKLYN BOTANIC GARDEN

PLANTS & GARDENS

BROOKLYN BOTANIC GARDEN RECORD

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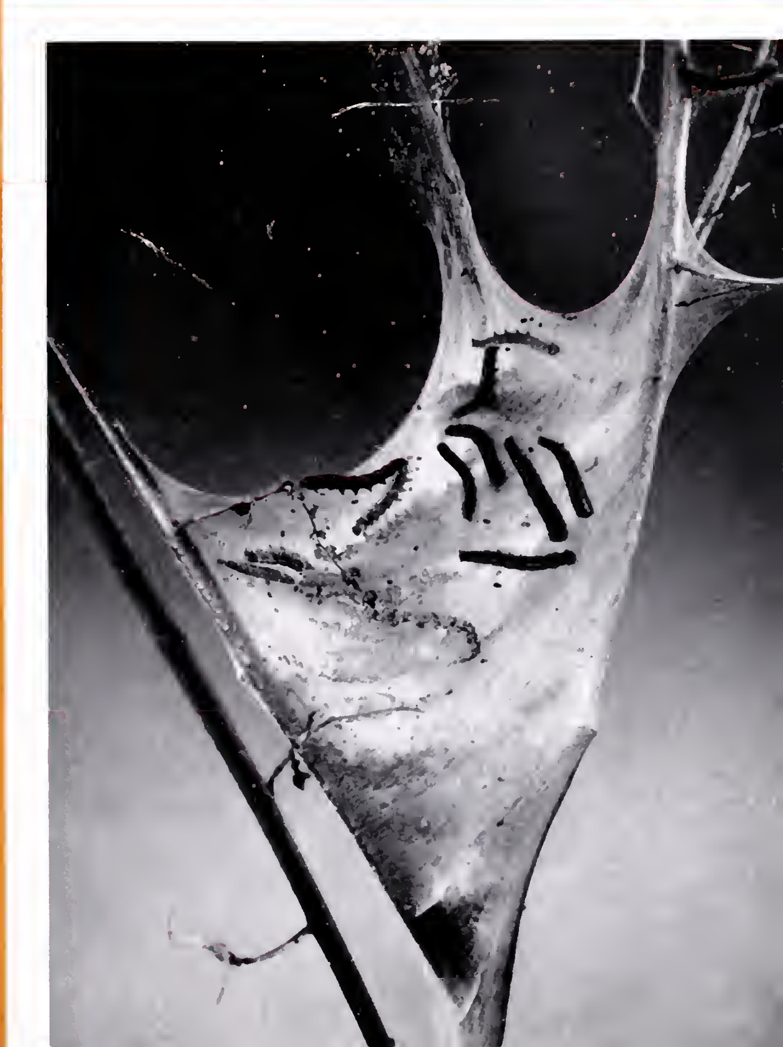

PESTS AND DISEASES of Ornamentals, Plants, and Lawns

Control
by
Insecticides
and
Fungicides

150 Pictures of
Plant Enemies

SPRING
1955

NEW SERIES
VOL. 11 No. 1

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PLANTS & GARDENS

VOL. 11 Spring, 1955 No. 1

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Editorial

CYNTHIA WESTCOTT, *Guest Editor*
PETER K. NELSON, *Associate Editor*
and the Editorial Committee of the Brooklyn Botanic Garden

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Spring 1955

Upon seeing the proof for this special PEST and DISEASE issue of PLANTS & GARDENS, one of the younger members of our staff volunteered that "we are not as pretty as usual, this time." True enough, diseases hold no special charm for anyone but the most dedicated pathologist. There is no light reading here, nor are there pictures of beauty in the garden. But to help keep the garden beautiful, this may easily become the most important 96-page handbook on the reference shelf.

To make ready use of these pages and the multitude of illustrations, refer to the index on pages 3 to 9. To understand the pests (as well as the diseases) read the text; to recognize them — study the pictures. Information on diseases of trees is necessarily limited in this issue, but can be found in PLANTS & GARDENS for Summer 1951.

The timing of sprays to control parasites described here is of key importance. Dates given are based on observations of the authors in their home localities. People who live farther South should begin spraying operations earlier, and farther North, later. County agents or agricultural experiment stations will gladly give advice on proper timing of sprays — and they are the people to consult, not the clerk at the local hardware store!

Guest Editor Westcott and her fellow authors, every one an expert in his field, have included something over 150 of the more "universal" insect pests and diseases of ornamental plants. With the fine cooperation of all concerned, we have tried to make this the best-illustrated book of its kind.

Here is a biological thought (philosophical, too): Most of the diseases of plants and of man are caused by fungi and bacteria. In short, the chief disease-producing parasites we now know are themselves plants. It is a paradox that some kinds of plants bring the world so much beauty, while others bring so many problems.

Yours sincerely,

George S. Avery Jr.

Director

Reminder:
MAY 17th — Tour of Westchester Gardens for BBG members and friends.
Sponsored by Garden Auxiliary for benefit of Fragrance Garden for the Blind.
Tickets $4.00. Folder on request.

An Index to the Pests and Diseases Described in This Handbook

The following list is a handy guide for the users of this book; it is not a complete check list of plant enemies

HOST *Pest or disease*	*Recognized by*	*Text on page*	*Picture on page*
Aconite			
Wilt	Leaves turn black	81	
African-violet (*Saintpaulia*)			
Cyclamen mite	Plants stunted, leaves abnormal, buds blackened	89	
Amaryllis			
Narcissus bulb fly	Large yellow maggot in rotting bulb	87	87
Andromeda (*Pieris*)			
Lace bug	Foliage blanched	18	18
Anemone			
Blister beetles	Long black beetles eat flowers, foliage	84	
Arborvitae (*Thuja*)			
Bagworm	Small bags hanging on twigs	83	83
Mites	Foliage yellow or brown, dusty	21	
Scales	Plants lose vigor	20	
Weevils	Twigs girdled	21	
Aster (*Callistephus*)			
Blister beetles	Black beetles eat flowers	84	
Leafhoppers	Small, wedge-shaped, hopping insects	87	87
Wilt	Plants wilt because of fungus in soil	80	
Yellows	Plants stiff, stunted, leaves yellow, flowers greenish	80	80
Azalea			
Flower blight (in South only)	Petals collapse to brown slimy mush	31, 70	71, 72
Lace bugs	Leaves stippled gray or yellow, rusty flecks on undersides	18, 85, 86	18, 85
Mites	Leaves look dusty	21	
Birch (*Betula*)			
Leaf miner	Leaves with large brown blotches	16	16
Bittersweet (*Celastrus*)			
Euonymus scale	Thin white scale all over vines	19	19
Boxwood (*Buxus*)			
Leaf miner	Blisters in leaves	17	17, 88
Psyllid	Terminal leaves cupped	17	17
Camellia			
Flower blight	Flowers turn brown	72	72, 73

HOST *Pest or disease*	*Recognized by*	*Text on page*	*Picture on page*
Camellia (cont.)			
Meadow nematode	Loss of vigor	77	76
Mites	Leaves yellow or gray	89	
Tea scale	White filaments on undersides of leaves, upper surfaces yellow	91	91
Chinese Evergreen (*Aglaonema*)			
Root rot	Leaves turn yellow or brown, die	56	56
Chrysanthemum			
Dodder	Orange tendrils entwining shoots	74	74
Four-lined plant bug	Depressed circles in leaves	85	85
Leaf nematode	Brown, wedge-shaped spots on leaves which die up the stem	76	
Verticillium wilt	Leaves die up the stem, often on one side	81	
Clematis			
Root-knot nematode	Stunting, wilting, sometimes death	75	75
Columbine (*Aquilegia*)			
Leaf miner	White, serpentine tunnels in leaves	88	88
Crabapple (*Malus*)			
Cedar-apple rust	Orange-yellow spots on leaves	79	79
Dahlia			
Leafhoppers	Leaves curled, brown margins, plants stunted	87	87
Daylily (*Hemerocallis*)			
Tarnished plant bug	Petals deformed	62	
Thrips	Blossoms streaked, foliage silvery	62, 92	27
Delphinium			
Black spot	Tarry black spots on leaves	75	75
Crown rot	Plants rot at crown, with round, reddish "mustard seeds" present	78	78
Cyclamen mite	Leaves deformed, buds black	89	89
Dieffenbachia			
Leaf spot	Translucent spots with yellow margins or reddish specks or yellow leaves	53	54
Stem rot	Leaves yellow, stems may break	56	56
Dogwood (*Cornus*)			
Borer	Burrows under the bark on trunk and around wounds	22	22
Spot anthracnose	Small round spots on flower bracts and leaves	80	80
Dracaena			
Tip blight	Tips straw-colored with black specks	55	55
English Ivy (*Hedera*)			
Aphids	Small black "lice" on new tips	82	
Mites (red spider)	Leaves dusty	89	27, 89
Scale, Florida red	Small, round, dark shells	91	91

HOST *Pest or disease*	*Recognized by*	*Text on page*	*Picture on page*
English Ivy (cont.)			
Scale, Oleander	Flat, thin, yellow scales	91	
Euonymus			
Crown gall	Rough galls on vine	74	74
Scale	Leaves, stems covered with thin, white scales and oyster-shaped brown scales	19	19
Gardenia			
White flies	Minute, white, moth-like flies, black mold on leaves	94	94
Gladiolus			
Botrytis blight	Spotting of leaves, flowers	47	47, 48
Corm rots	Stunting, yellowing of plants	48	48, 49
Scab	Brown, varnished spots on corms	48	49
Thrips	Flowers streaked, leaves silvered	92	
Viruses	Flowers greenish, misshapen, streaked	49	
Hawthorn (*Crataegus*)			
Fire blight	Twigs or branches suddenly die back, turn black	69	
Lace bugs	Leaves stippled white, dark specks on undersides	86	
Hemlock (*Tsuga*)			
Spruce mite	Foliage nearly white	21	21
Weevils	White grubs feeding on roots, trees may die	21	
Holly (*Ilex*)			
Leaf miners	Blotches and tunnels in leaves	17, 18	17
Hollyhock (*Althaea rosea*)			
Rust	Orange-red pustules on undersides of leaves and on stems	79	78
Hyacinth			
Bulb nematode	Bulb scales swollen, dark, gummy, leaves yellow, distorted	51, 76	76
Mites	Minute white mites in rotting bulb		90
Mosaic	Foliage mottled	51	
Yellows	Leaves and bulbs yellow	51	
Iris			
Aphids	"Lice" on foliage and in bulbs	58	
Borer, iris	Leaves ragged, water-soaked, large pinkish worm in rhizome	57	57
Borer, stalk	Brown and white striped caterpillar in stalk	58	
Crown rot (southern blight)	Leaves dying back and small, brown, seed like bodies close to plant	49, 60, 78	50, 60, 78
Leaf spots	Brown spots on leaves, tips may dry	49, 59, 62	49, 61
Mosaic	Mottled leaves	50, 61	51
Rhizome rot	Masses of hard black bodies on rhizomes, interiors gray, felt-like	61	
Scorch	Leaves turn bright reddish-brown	62	
Soft rot	Soft stems and rhizomes, sour odor	51, 59	
Thrips	Very small insects in flowers	58, 92	

HOST *Pest or disease*	*Recognized by*	*Text on page*	*Picture on page*
Juniper			
Bagworm	Bags on twigs	83	83
Cedar-apple rust	Round brown galls on twigs	79	79
Scale	Small, round, white scales on needles	20	20
Spruce mite	Shrubs yellow, with cobwebs	21	21
Lawn grasses			
Brown patch	Round patches of water-soaked leaves, later turning light brown	65	
Chinch bug	Lawns turn light gray-brown, small red and brownish-black bugs in crowns of plants	64, 86	
Cutworms (armyworms)	Brown, greenish, or nearly black, striped caterpillars chew off leaves	64, 86	
Dollar spot	Small round spots of fine white mold, dead plants bleached	66	
Fading-out (black mold)	Serpentine, yellow-green dappling on lawn	65	
Going-out (leaf spot, foot rot)	Plants appear to thin out in rather large areas	65	
Grubs, white	Turf loose and dead or stunted in patches which may be lifted up easily	63, 84	64, 84
Moles	Ridges in sod	65	
Nematodes	Patches of dying leaves give yellow cast to lawn	65, 75	76
Pink patch (red thread)	Patches of pink, gelatinous mold in wet weather, become bright coral-red when dry	66	
Rust	Yellow-orange or reddish pustules on leaves and stems	67	
Slime mold	Slimy masses on grass in wet weather, becoming ashy when dry	67	
Snow mold (winter scald)	Patches of pink, gray, or dirty white mold on lawns as snow melts	67	66
Sod webworm	Thick-bodied caterpillars in web tunnels at bases of plants chew leaves and stems	64, 93	
Lilac (*Syringa*)			
Borer	Holes in bark, limbs dying	22, 84	
Giant hornet	Twigs and small branches girdled	93	93
Powdery mildew	White coating on foliage	77	77
Scale	Oyster-shaped shells on bark	19	19
Lily			
Basal rot	Rot of basal portion of bulb	46	46
Botrytis blight	Flowers, leaves spotted and rotted	46, 69	46
Mosaic	Light and dark green mottling	47	
Magnolia			
Scale	Large, brown, humped scales on twigs and branches	91	91
Mimosa			
Webworm	Webby nests in trees	93	
Wilt	Trees die	81	
Mountain-laurel (*Kalmia*)			
Leaf spot	Brown or gray spots in leaves	75	75

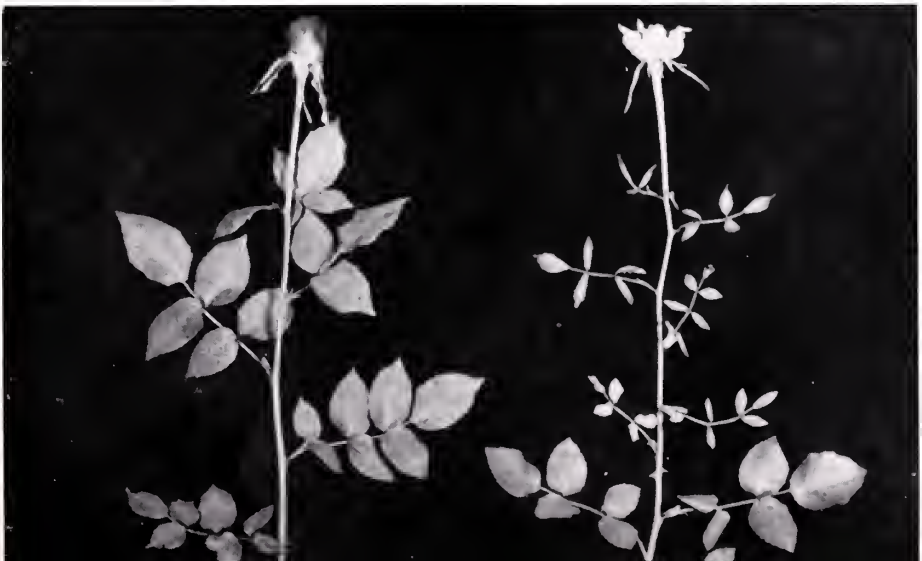
HOST *Pest or disease*	*Recognized by*	*Text on page*	*Picture on page*
Narcissus			
Basal rot	Chocolate-brown rot of base of bulb	45	45
Bulb fly	Large maggot in rotting bulb	87	87
Bulb nematode	Dark circles in bulb when cut across	76	76
Leaf spot	White mold on brown spots; brown, corroded streaks—scorch; brown spots with gray fuzz—fire	45	
Mosaic	Leaves mottled, flowers streaked	46	45
Nephthytis			
Leaf spot	Reddish-brown spots with yellow borders	54	54
Pachysandra			
Euonymus scale	Thin, white scales	19	19
Palms			
False smut	Yellow spots with black scabs	55	
Leaf spot	Reddish to yellow transparent spots	55	55
Peony (*Paeonia*)			
Botrytis blight	Young shoots rot, buds turn black	69	69, 70
Rose chafer	Tan beetles eat flowers	24, 84	24
Thrips	Buds fail to open, flowers turn brown	92	27
Philodendron			
Leaf rot	Water-soaked areas and blisters, leaves collapse	53	53
Leaf spot	Circular, tan blotches in leaves	52	52
Phlox			
Mites (red spider)	Leaves yellow, cobwebby	89	27, 89
Powdery mildew	White coating on leaves, stems	77	77
Pilea			
Leaf spot	Circular, gray or tan, corky spots	55	
Pine			
Bark aphid	White, woolly appearance on trunk	82	
Sawflies	Needles chewed off	90	90
Spittlebugs	White, frothy masses	92	92
Webworms	Needles tied together	93	93
White-pine weevil	Leaders killed	94	
Privet (*Ligustrum*)			
Lilac borer	Holes in stems	22	
Privet thrips	Leaves dusty	92	
Pyracantha			
Fire blight	Branches die back	69	
Lace bug	Leaves stippled gray or white	86	
Webworm	Twigs webbed together	93	
Rhododendron			
Borer	Holes in trunk and larger limbs	84	85
Lace bugs	Leaves stippled yellow, rusty flecks on undersides	18, 85	85
Rose			
Aphids	Pink or green "lice" on buds	26, 82	26
Beetles, Japanese	Metallic green and copper beetles eat flowers, foliage	23, 83	23, 83

HOST *Pest or disease*	*Recognized by*	*Text on page*	*Picture on page*
Rose (cont.)			
Beetles, leaf	Small green beetles chew holes in buds	24	24
Beetles, rose chafer	Tan, long-legged beetles feed on flowers	24, 84	24
Black spot	Black spots with fringed margins, leaves may turn yellow	37, 40, 41	37
Brown canker	White spots with reddish borders	40, 42, 73	40
Galls	Swelling at crown or on canes	27, 74	27
Leaf-cutter bee	Circles cut from margins of leaves	25, 83	25, 83
Leafhoppers	White stippling on leaves	25, 87	25, 87
Midges	Small buds turn black	26, 87	26, 86
Mites	Leaves yellow or brown, stippled, with webs on undersides	27	27, 89
Powdery mildew	Leaves curled or deformed, with white coating, buds do not open	38, 42	38
Rose-slug	Windows eaten in leaves	24	24
Rust	Small orange or black masses of spores on undersides of leaves	39, 42	39
Scale	Round, white shells on canes	26	26
Spot anthracnose	White spots with reddish borders on leaves and canes	80	80
Stem borers	Holes in pith	28, 85	28
Thrips	Flowers fail to open or are distorted, petals brown	27, 72	27
Snapdragon (*Antirrhinum*)			
Rust	Chocolate-brown spore pustules on undersides of leaves	79	78
Spruce (*Picea*)			
Gall aphids	Galls at bases of Norway spruce twigs, at tips of blue spruce	82	82
Mites	Branches grayish, cobwebby	21	21
Syngonium			
Leaf spot	Reddish-brown spots with pale borders	54	54
Tulip			
Botrytis blight	Leaves and flowers spotted, gray fuzz	44, 69	44, 70
Mosaic	Flowers streaked or "broken"	44	43, 44
Violet			
Scab	Raised spots on leaves and stems	80	80
Yew (*Taxus*)			
Taxus mealybug	White, cottony masses on bark	20	21
Taxus scale	Soft, brown, hemispherical scales	20	20
Weevils	White grubs feed on roots; dark hard weevils feed on needles at night	21, 94	
Zinnia			
Mildew	White coating on plants	77	76
Many plants attacked by the following general pests (partial list)			
Aphids	Variously colored plant "lice" on roots, stems, leaves, flowers	82	26, 82
Beetles, Asiatic garden	Copper-brown beetle, feeds at night	84	84

HOST *Pest or disease*	*Recognized by*	*Text on page*	*Picture on page*
Many plants (cont.)			
Beetles, Japanese	Metallic green and copper beetles eat flowers, foliage	23, 84	23, 84
Beetles, spotted cucumber	Greenish beetles with black spots eat flowers in late summer	84	
Cutworms	Seedlings cut off	86	
Damping-off	Seedlings rot before or just after emerging from ground	78	
Fall webworm	Webs tie ends of branches together	93	93
Four-lined plant bug	Depressed circles in leaves	85	85
Leafhoppers	Small, wedged-shaped, hopping insects	87	87
Mealybugs	Small insects covered with cottony white wax	88	88
Millipedes	Wiry worms with many legs, coil up like watchspring, scavengers	88	
Mites, red spider	Dusty cobwebs on undersides of leaves; mites minute, greenish, yellow, or reddish	89	27, 89
Oystershell scale	Brownish-gray scales, 1/8 inch long, shaped like oyster shells, covering branches and twigs	19	19
Root-knot nematode	Knot-like galls on roots	75	75
Slugs	Soft-bodied mollusks like snails without shells leave slimy trails, chew large holes in leaves	92	92
Sowbugs	Small, gray, oval animals look like minute armadillos	59, 92	59
Tent caterpillars	Make webs in crotches of branches	86	86, cover
Weevil, imported long-horn	Small, grayish, hard-shelled insects with long antennae and heads prolonged into a snout	94	
Weedkiller fumes (e.g. 2,4-D)	Leaves fernlike, twisted	81	9, 81

Rose at right shows what happened to plants in a bed near lawn which was sprayed with 2,4-D to get rid of dandelions and plantain. A slight breeze caused spray to drift to the rose bed, and developing leaves and flowers were distorted and stunted. Left, normal foliage and flower.

Boyce Thompson Institute photo



FOREWORD

Cynthia Westcott

RECENTLY a national magazine asked me to do a general article on garden pests and diseases and their control in not over 1000 words. I refused. Twenty years ago I could have made a stab at it but today the situation is far too complicated. It is distinctly a disservice to home owners to imply that pest control is easy, to be undertaken with little advance thought, applying wholesale any all-purpose mixture the clerk at the nearest seedstore recommends. Unless you are prepared to recognize specific pests and to apply the right chemical at the right time with due regard for the safety of yourself and your plants, then it is better to omit chemical control altogether and to rely on general sanitary measures. Nature will eliminate the unfit and you'll still have a garden of sorts.

Plant disease is difficult to define. We think of it as an abnormal process, something that disturbs the functioning of a plant and produces recognizable symptoms: leaf spots, cankers, blighted shoots, general wilting, overgrowth, stunting, etc. These symptoms can be due to such pathogenic agents as bacteria, fungi, or viruses or to unfavorable environmental conditions—too high or too low temperature, too much or too little water in the soil, malnutrition or overfertilization, too acid or too alkaline a medium. These environmental diseases are omitted from this handbook for lack of space.

We usually consider the work of insects and other animals as injury rather than disease, just as in humans we distinguish between the sucking of a mosquito or the bite of a dog and the miserable process of the common cold. But sometimes the action of the insect causes the plant to go haywire and to produce a gall, or to pucker and curl its leaves, and the distinction between disease and injury is not so clear. Nematodes are animals but the troubles they cause are usually called disease.

There are nearly a million known species of insects in the world and about 10,000 of these are considered public enemies in the United States. There have been perhaps 100,000 species described among the fungi, with possibly a third capable of causing plant disease. Not even an entomologist expects to know all the insects he is likely to meet, nor can a plant pathologist tell at a glance diseases that are not in his particular field. So what is an untrained home gardener to do?

Well, it is possible to learn to recognize some of the more common troubles in your own back yard just as you distinguish your neighbors from all the millions of people in the United States (I am not implying that neighbors are pests and there are many more friendly insects in our gardens than injurious ones). You recognize the insect pests not only by their own appearance but by the pattern of injury they make on the plant. You'll learn to know types even if you cannot always distinguish individuals.

Those presented here are limited to the enemies of the basic ornamental planting around a home: shrubs and small trees that can be taken care of without calling in a tree expert and power sprayer, roses, bulbs, lawns, a few perennials, a few house plants. The authors, each a specialist, take up the more common pests in their own fields in enough detail so that you can recognize the disease or insect, know how it works, and why you choose certain control measures and not others. The article on Fungicides by Dr. McClellan and the one on Insecticides and Miticides by Dr. Hamilton are required background reading before you can understand the chemical controls suggested by the other authors.

INSECTICIDES AND MITICIDES AND THEIR USE

An alphabetical check list

Clyde C. Hamilton

AN INSECTICIDE is a chemical or combination of chemicals which is used to kill insects or other closely related arthropods, such as millipedes, centipedes, and spider mites. Before these insect killers can be manufactured and shipped for sale in interstate commerce they must be approved and registered by the Federal Government. This gives protection to the consumer against fraudulent claims. There are now approximately 30,000 insecticides, fungicides, herbicides, and rodenticides registered and sold. It is possible in this article to mention only a few of the insecticides. But you say, "How am I going to choose the right one to use?" Here we will attempt to help you by discussing the various types of insecticides and their best uses. For example DDT, pyrethrum, and rotenone represent three different types of insecticide materials. There are, however, many different brands of each of these three types manufactured and sold by different companies. Many of these insecticides are quite similar in their formulation and it makes little difference which one is used providing directions on the container are followed.

Insecticides may be in the form of dusts, sprays, fumigants, and aerosols or combinations of these forms. Dusts may kill by contact action, stomach poison action, or fumigating action. They are convenient and usually clean to use and in many instances are more desirable than sprays. They are excellent for plants with thick foliage, giving good distribution. Sprays are generally better for hard-to-kill insects and spider mites, or for thin foliage plants or dormant applications. Spray applications usually adhere better than dust applications. Aerosol insecticides are sprays dispersed in very fine drops, usually from a metal container (bomb) in which the active ingredient is dissolved in a liquefied gas. Aerosol bombs are of two types, one which is for use in closed places such as greenhouses, and a second type in which the particles are larger and are applied lightly and directly to the plant or other object to be sprayed. These small handy spray bombs are very convenient and clean for house plants.

The problem of what to use and when to use it is frequently quite confusing. The principal thing to determine is how the insect or spider mite is damaging the plant and then to use the type of material best suited for its control. The particular brand names frequently make little difference except possibly in cost. One can purchase combination materials, i.e., those that contain stomach poisons, contact poisons, miticides, and fungicides. These are excellent where a variety of plants are to be treated. Dust mixtures are usually satisfactory for the small home garden, particularly if they are used on a regular schedule of applications made once every week.

Read directions carefully and then follow these directions. They are placed on the container to insure good control of the pest and for your protection. Some insecticides are poisonous. If very dangerous they are marked with the skull and crossbones in red. Observe the precautions mentioned for their use.

List of Some Insecticides and Miticides

The following list of insecticides is intended primarily for use by the home gardener, especially those interested in growing ornamental plants. It is intended to show types of insecticides, omitting brand names. Each kind of insecticide is manufactured by many different companies under different brand names, most of which are available in small packages. Read and follow directions carefully. They are put there for your protection and use.

Aerosol Sprays. Usually insecticides dispersed in small drops from metal containers in which the active ingredient is dissolved in a liquid gas. Aerosols may be made with a number of different kinds of insecticide materials, such as pyrethrum, rotenone, DDT, lindane, malathion, chlorobenzilate, and Aramite. There are two types, one for use in closed places such as greenhouses and the second in which the insecticide is applied directly to the plant, usually at a distance of 18 to 20 inches. Only a few seconds are required to spray a plant. Don't overspray or injury may develop. Read directions carefully. These aerosol sprays are convenient and clean, and they are very effective for control of most insects and mites on most house plants.

A number of insecticides and fungicides are now available in handy aerosol "bombs." In using, bomb should be kept at least 18 inches from plants. *Eiser*

Aldrin. A new synthetic chlorinated insecticide which shows considerable promise for control of many insects such as leaf miners, sucking insects, grasshoppers, some caterpillars, and grubs in the soil. It should be available as a dust or as an emulsion. Follow directions carefully.

Aramite. An excellent new miticide which is relatively non-toxic to warm-blooded animals and to plants. It does not kill beneficial insects. It is marketed as a 15 per cent wettable powder in emulsions and in dusts. It is a good spray for control of most mites, such as the common two-spotted spider mite, the boxwood mite, the spruce mite, and others.

Ant Poisons. These may be poison baits containing arsenic, thallium sulfate, or other stomach poisons; they may be dusts or sprays containing chlordane, aldrin, or some of the other chlorinated hydrocarbon chemicals. A 5 per cent chlordane powder or a 3 per cent aldrin powder, dusted lightly on plants, turf or soil infested with ant hills will give a good control.

Benzene Hexachloride (BHC). This is a chlorinated hydrocarbon insecticide which was developed during the war at about the same time as DDT. It has a very persistent, pungent, disagreeable odor and for this reason is not used much in small packages for home owner spraying. Its principal active ingredient, known as the "gamma isomer," is refined and known under the name "lindane." See lindane for its uses.

Chlordane. A complex chlorinated hydrocarbon insecticide used as a stomach or contact poison, and having slight fumigating properties. It is highly effective against ants, grasshoppers, sowbugs, beetle grubs in lawns, and black vine weevil grubs attacking yew and rhododendron. It is available as a 50 per cent wettable powder to be used as a spray, a 5 per cent dust for ant and grub control, and as emulsions containing different percentages of active ingredients. It is sold under many brand names.

Chlorobenzilate. A new complex chemical developed for use as an acaricide or miticide. It has a good toxicity to most species of spider mites, has good residual properties, is compatible with most insecticides and fungicides, and is safe to use on most plants. It is not an insecticide, will not kill beneficial insects, and has a low toxicity to warm-blooded animals. Chlorobenzilate is manufactured as a 25 per cent wettable powder and as a 25 per cent emulsion. It is also available in aerosol bombs for greenhouse use.

DDD, TDE or Rothane. A chlorinated hydrocarbon insecticide closely related to DDT. It has some special uses but is not of particular value to the home gardener.

DDT (dichloro diphenyl trichlorethane). This insecticide has received great publicity because of its rapid development during and immediately after World War II for its use in combating typhus, malaria, and yellow fever, and for its rapid development for control of crop-infesting insects. It acts as a stomach poison and a contact poison and has good residual properties, killing insects for days after it has been applied to a surface. It is toxic to most kinds of insects, is relatively safe on foliage, and is not important as a toxicant against warm-blooded animals. DDT insecticides are available as dusts containing 1 to 10 per cent active ingredients, as wettable powders, as emulsions containing 25 to 33 per cent DDT, in solutions in light oils for use in airplanes for spraying forests, etc., for cankerworms, gypsy moths, sawfly larvae, and many other pests. It is also available in aerosol bombs. It is compatible with most insecticides and fungicides and is frequently found combined with them in the finished product. It is a good insecticide for control of leaf-eating insects, some sucking insects, and the emerging adults of such leaf-mining insects as the boxwood leaf miner and the holly leaf miner. There are many formulations containing DDT and it is sold under many brand names.

Unfortunately DDT has some bad effects. It kills parasites and predators of spider mites, scale insects, etc. and frequently permits these pests to develop without restraint. It is not safe to use on tomatoes, cucurbits, and some other plants. Its continued heavy use results in a build-up in the soil in which some plants will not grow. Grass will tolerate large concentrations in the soil and it is used extensively for Japanese beetle grub control. It should not be used near garden pools containing fish or where water from sprayed areas will drain into fish pools.

Derris. This is a powder containing rotenone and is obtained from a tropical shrub. The finely ground powder may be diluted in water and used as a spray or diluted with an inert powder and applied as a dust. Derris powder is quite toxic to most insects, acting as a contact insecticide, and is relatively nontoxic to warm-blooded animals.

Dieldrin. An insecticide that is similar to aldrin in many respects. It is somewhat less specific than aldrin but exerts a much longer residual action. It is used on a wide variety of insects.

Dimite. This is an acaricide or miticide sometimes known as DMC. It is not toxic to insects and will not kill parasites and predators. It is compatible with most insecticides and fungicides excepting those of an acid nature. It is not toxic to warm-blooded animals.

Dormant Oil Sprays. These are usually petroleum type oils which have been refined to remove impurities and to make them safer for use on plants. These oils are mixed with emulsifiers so that when diluted with water the oil will disperse in fine droplets producing a milk-like emulsion. Dormant oil sprays are used mostly in early spring, March or April, before the buds begin to swell. They should never be applied when the temperature is below 40° or 45° F. or when there is a possibility of the temperature dropping to freezing before the spray dries on the plants.

Dormant oil sprays are used mostly for control of those stages of insects that pass the winter on twigs, limbs and exposed places. Therefore thorough spraying and good wetting are essential.

Heptachlor. This insecticide is somewhat similar to chlordane but is more toxic to many insects and does not retain its residual toxicity so long. Heptachlor is an excellent insecticide against many kinds of insects but is particularly effective against grasshoppers, many weevils, their grubs, and a number of soil-inhabiting insects, such as Japanese beetle grubs, black vine weevil grubs, wireworms, seed corn maggots and others.

Lead Arsenate. This insecticide is a white powder which is an excellent stomach poison for most biting and chewing insects. In some packages it is colored pink so that it will not be mistaken for flour, baking soda, etc. It may be used as a spray suspended in water or as a dust, usually diluted with other insecticides, fungicides, or inert materials. The normal dilution as a spray is 3 pounds to 100 gallons of water or 1 ounce to 2 gallons of water. It adheres well but discolors foliage and should not be used on edible portions of plants for at least a month or more before the plant is to be harvested.

Lindane. This is the common name for the purified gamma isomer of benzene hexachloride. It is an excellent contact insecticide, has considerable residual properties, and when applied to the surfaces of leaves containing leaf-mining insects it will kill many of the young larvae recently hatched from the eggs. Where the egg laying period of a leaf-mining insect may extend over a period of 2 or more weeks it is usually advisable to make two or more treatments. The first treatment should be made a week or 10 days after the beginning of egg laying and the second 10 days or 2 weeks after the first one. Lindane insecticides are available as sprays containing 5, 10, or 20 per cent lindane, wettable powders containing 25 per cent lindane, or as dusts containing 1 to 5 per cent lindane.

Methoxychlor. This is an analog of DDT and is quite similar to DDT in many respects. It is effective against most of the insects that are killed by DDT and is safe to use on plants. It has one advantage over DDT in that it is not nearly as toxic to warm-blooded animals. It can be used on plants where a more poisonous material might accumulate poisonous residues. Methoxychlor can be used on bean foliage for control of the Mexican bean beetle. It is available as dusts, wettable powders, and emulsions, and will mix well with other insecticides and fungicides.

Malathion. This is a phosphate type of insecticide similar to parathion but less toxic to warm-blooded animals. It is considered to be less toxic to warm-blooded animals than is rotenone. It has been approved for packaging and use in small size packages for the home gardener. Malathion has a wide range of toxicity to many insects and to spider mites. Recent work indicates it is quite effective in killing the crawling stages and half-grown stages of many scale insects. This makes it a useful spray for scale insect control where the dormant spray has not been applied and also on flowers and other tender plants during the summer time. It may be necessary to make several spray treatments 2 or 3 weeks apart to obtain good control. Malathion insecticides are available in 50 per cent emulsions and 25 per cent wettable powders. The emulsion form is best for home garden use.

Metaldehyde. This is the active ingredient in many of the baits sold and used for control of snails, slugs and sowbugs. It is very attractive to these pests as well as poisonous. Most baits contain 3 to 5 per cent metaldehyde plus about 5 per cent calcium arsenate or one of the fluorine poisons. It is also prepared as a 10 per cent dust which is used by greenhouse men.

Miscible Oils. See Dormant Oils.

Nicotine. An alkaloid found in tobacco plants and principally obtained from waste tobacco items and refuse from cigarette and cigar manufacturing plants. It is available for insecticidal use as a 40 per cent nicotine sulfate, a 50 per cent free nicotine, or as lesser concentrations of either of these two materials mixed with other insecticides. The nicotine sulfate is relatively non-volatile and leaves some residual deposit on sprayed surfaces. The free nicotine is quite volatile and has considerable use as a fumigant. Nicotine makes a good dust insecticide and is manufactured in pressure fumigators which generate the nicotine smoke aerosols. It has relatively little stomach poison action although it can be prepared as a fixed nicotine compound and used for codling moth control.

Ovotran. This is one of the newer acaricides or miticides. It is not as effective against adult mites as some of the other miticides but is very effective against the eggs and immature stages of many species of mites because of its residual action. Ovotran miticides are not effective against insects, therefore they do not destroy parasites or predators of spider mites.

Parathion. This is an organic phosphate insecticide which has a wide range of toxicity to most insects and spider mites. It is one of the most effective insecticides known. Unfortunately, however, it is rather poisonous to warm-blooded animals, presenting some hazard to the user, and it kills beneficial insects as well as the injurious ones. Directions for its use and precautions mentioned in handling it should be carefully followed. Malathion, which is somewhat similar to parathion, has replaced it for small package uses because of its much greater safety to warm-blooded animals.

Pyrethrum. One of the early plant insecticides, being known for a long time as insect powder. It is obtained from the dried flower heads of several species of pyrethrum plants. The active principle is extracted by solvents and prepared as emulsions for dilution in water, as solutions in light volatile oils for use as fly sprays, or the ground flower heads or the pyrethrum extract adsorbed on inert material and used as dusts. The pyrethrum insecticides are not toxic to warm-blooded animals but are quite toxic to many insects.

Rotenone. The principal toxic ingredient obtained from the roots of derris and cube plants. The roots may be ground and the powder used as a wettable spray or the powder may be diluted with inert material to give ½ to 1 per cent rotenone and used as a dust insecticide. The rotenone and some other active ingredients called rotenoids can be extracted with suitable solvents and these extracts made usable with water and then applied as sprays. The extracts may also be impregnated on inert powders and the rotenone used as dusts. Rotenone is a very effective contact insecticide against many insects. It has some residual action which usually lasts only a few days. Rotenone insecticides are relatively non-poisonous to warm-blooded animals and are not poisonous to handle. It is a good contact insecticide for home gardeners' use.

Sulfur. In the form of liquid lime-sulfur this is a contact insecticide and will control many scale insects, spider mites, and their eggs. The concentrated lime-sulfur solution is used as a 1 to 8 dilution with water as a dormant spray and 1 to 40 or 50 as a foliage spray. Sulfur in a fine powder form is frequently used with other insecticides and fungicides to give the dust better flowability and to add to the dust's miticidal and fungicidal properties.

INSECT PESTS OF ORNAMENTALS AND THEIR CONTROL

How to keep shrubs and small trees in home plantings free of their more important insect enemies

John C. Schread

THE increase in the number of small home owners in recent years, in addition to the trend towards a more garden-conscious public, has created a greater demand for ornamental trees and shrubs. As a result, nurserymen have extensive acreage of a single species or several varieties of a species.

Furthermore, new varieties are being introduced from abroad, or developed in this country, augmenting the long list of plants now available.

Although certain species of plants appeared to be almost free from insect enemies and diseases when grown alone or in small numbers, the recent increase in their culture has resulted in a phenomenal rise in insect pests.

Another important consideration of the problem is the continued and inadvertent use of certain of the newer insecticides such as DDT for the control of insect pests. The practice quite often results in the destruction of parasites and predators that help to hold plant pests at innocuous levels. Thus an uninhibited rise in plant-eating insect populations has occurred.

Birch leaf miner eats away the tissues between upper and lower surfaces of leaves of many kinds of birches.

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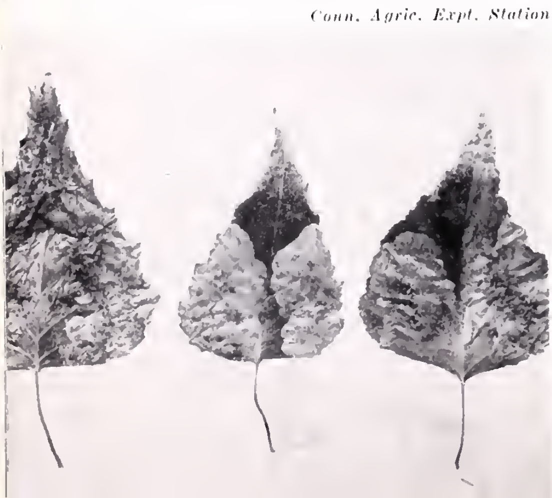


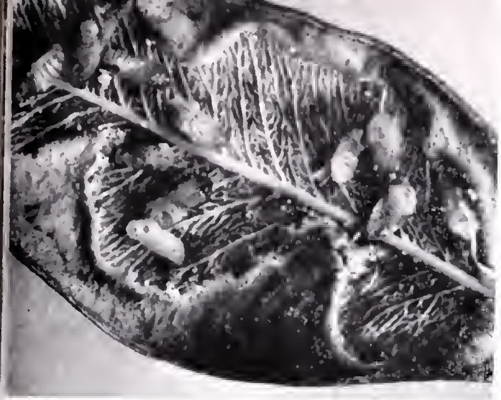
Despite the fact that plant propagators are fighting the insect menace relentlessly, some insects may escape treatment or be overlooked during the growing season. A few plants thus infested may be responsible for a recurrence of outbreak.

Once a pest gets started on the home grounds or in several places in a neighborhood, it may spread from place to place doing considerable damage before its presence is recognized. Hence it is wise to be alerted to the probability of its presence and to cope with it whenever it occurs.

Birch Leaf Miner

The birch leaf miner appears to be more abundant and consequently more injurious to birch foliage during the past few years than heretofore. The birch species most seriously damaged are the gray birch (*Betula populifolia*), white birch (*B. papyrifera*), and the European white birch (*B. alba*). The insect passes the winter as a mature larva in an earthen cell in the soil beneath the trees. In the spring it transforms to an adult sawfly, black in color and about 1/16 of an inch long. Eggs are deposited in young leaves only. As a result all of the leaves are infested in the spring. Later in the season only the new leaves in the tops of the trees or on young sprouts are infested. There are several generations of sawflies during the growing season.

For years nicotine sulfate gave good control. Recently it has been shown that malathion or lindane used at the rate of



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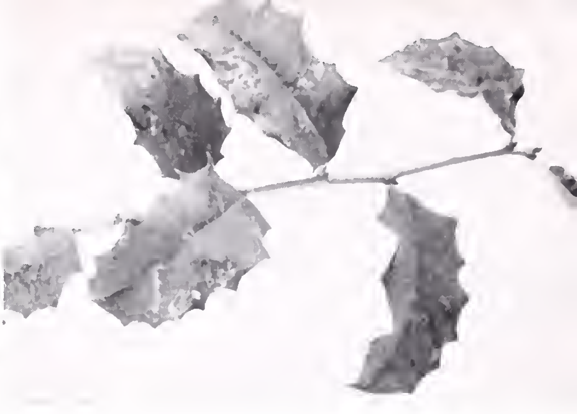
Boxwood leaf opened by pulling away under side to show leaf miners destroying inner tissues. About 4 times natural size. (Also see page 88.)



Feeding of holly leaf miner results in irregular, light-colored tunnels in leaves.

1 to 2 teaspoonfuls of emulsion in 1 gallon of water when the birch leaves are inhabited with eggs and larvae in May will destroy the population. One treatment well timed between May 15 and 25 may be all that is necessary to control the first brood. Treatments made July 1 and again 10 days to 2 weeks later should control the second brood of miners.

Boxwood Leaf Miner and Psyllid

Boxwoods are frequently damaged by leaf miner and psyllid. The adult of the boxwood leaf miner is a delicate orange-yellow midge or fly about 1/8 inch long. It lays its eggs during late May and early June* in boxwood foliage. As the miners develop they create blister-like swellings on the undersides of the leaves. There is only one generation a year. The adult of the boxwood psyllid is grayish-green in color and about 1/10 inch long. The first brood is active during May, causing a cupping of the terminal leaves of infested boxwoods. Later the greenish-colored nymphs with wax-like pellets adhering to their bodies disperse throughout the plants.

Nicotine sulfate has given good control in the past. Experiments conducted since 1950 have demonstrated the effectiveness of DDT emulsion at the rate of 1 teaspoonful per gallon of water in controlling adult leaf miners, or malathion or lindane emulsion at a comparable dose for control of the miners in the leaves. Psyllids were best controlled with lindane and nicotine sulfate at dosage levels suggested for leaf miner. Treatments to control boxwood pests should begin about mid-May. Retreatment 4 weeks later may be pursued if necessary.

Holly Leaf Miner

Two species of holly leaf miner are recognized, the European form *Phytomyza ilicis* Curtis and the American form

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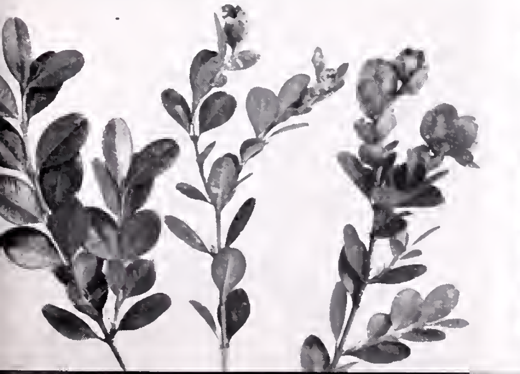
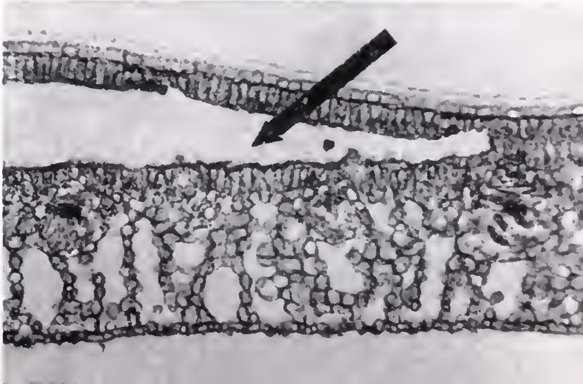
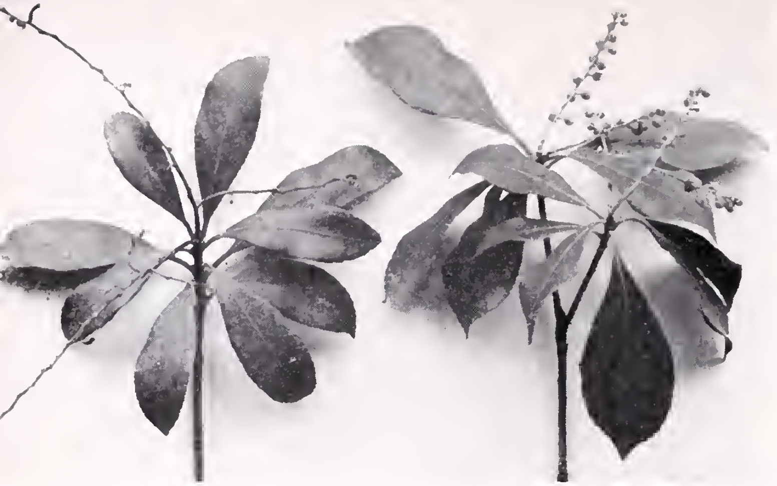
*Mid-May in New Jersey.—Ed.

Characteristic cupping of boxwood leaves at tips of twigs is symptom of boxwood psyllid infestation; healthy twig at left.



Highly magnified cross-section through holly leaf showing tunnel (arrow) made by leaf miner. *Buhle*





Untreated andromeda (*Pieris japonica*) twig at left shows foliage injury caused by andromeda lace bug.

Conn. Agric. Expt. Station photos

P. ilicicola Loew. Perhaps under most conditions the former species is seen more often in the American or Christmas holly than the latter.

For the most part, habits of the two species are the same. There is only one brood of each a year. The small, black adult flies, varying from 1/32 to 1/16 of an inch in length, begin to emerge about the middle of May. For perhaps 10 days before egg laying commences the female uses her ovipositor to puncture the tissue of the newly forming leaves. Both the males and females feed on the juices which exude from the wounds. Leaves seriously damaged in this manner may become badly distorted.

The larvae which hatch from the eggs form almost inconspicuous tracings at first. Later, however, as they grow larger, the mines become more conspicuous and may broaden out towards the anterior end into irregular blotches. This particular aspect of the mines appears to be more characteristic of the European than of the American species. By late summer many of the larvae are through feeding. They overwinter in this stage.

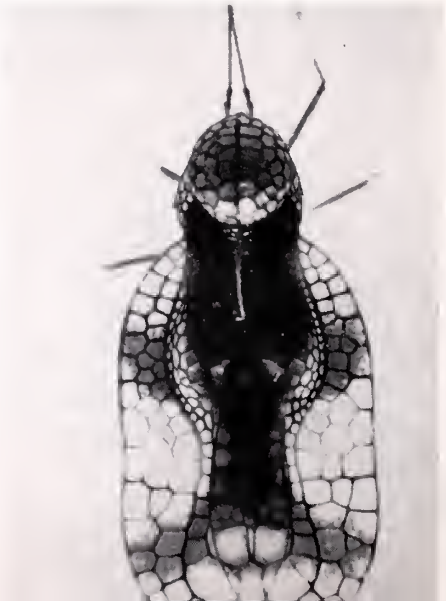
Control of the overwintering miners with lindane and related insecticides has not been successful but newly developing larvae may be destroyed when spray treatments are made with these insecticides during late July. DDT or dieldrin treatments applied once or twice from late May through mid-June should give good control of adult flies.

Lace Bugs

Three species of lace bugs occur on andromeda (*Pieris*), azalea, and rhododendron. The most recently introduced is the andromeda lace bug (*Stephanitis globulifera* Mat.). It usually restricts its feeding to *Pieris japonica*, but may sometimes be found on certain deciduous azaleas. Both *S. pyrioides* and *S. rhododendri* attack azaleas, and the latter species occurs on rhododendron.

The adults of the three species resemble one another closely. They are delicate little bugs about 1/8 of an inch long, lace-like in appearance, and usually whitish in color. The exception to this is the andromeda lace bug, which has a much darker

Adult andromeda lace bug about 24 times life size.



head and wing markings. The adults and nymphs feed by sucking the sap from the undersides of the leaves. This causes a mottling or blanching of the foliage.

There are several broods of the insects a year. Winter survival occurs in the eggs imbedded in the undersides of the leaves. They are sometimes in groups adjacent to the midrib, sometimes singly in random pattern.

Control of lace bugs should not be difficult so long as the lower surface of the foliage is sprayed or dusted. Nicotine sulfate can be used for the purpose, but a more lasting insecticide such as malathion is desirable. A thorough treatment made during early June may be all that is necessary. If a second is required, it should be applied in early August. (Editor's note—I have had excellent control with lindane but it has to be applied in May for the andromeda lace bug which hatches early in New Jersey.)

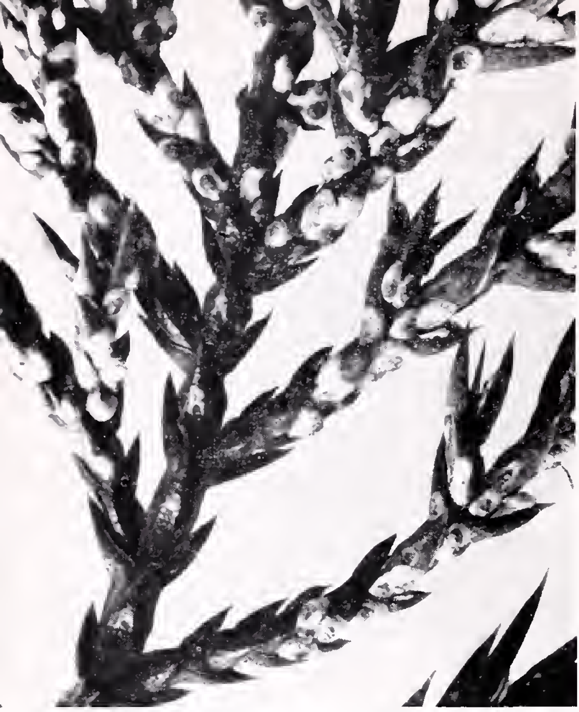
Oystershell and Euonymus Scale

The oystershell scale (*Lepidosaphes ulmi* L.) and the euonymus scale (*Unaspis euonymi* Comst.) are two of the most persistent and injurious of all of the scales attacking ornamentals. The former attacks more than 100 varieties of deciduous trees and shrubs. It feeds on all parts of infested plants excepting the leaves and roots. Seriously infested plants may die. The female scale is 1/8 inch long, brownish-gray in color, and shaped like a tiny oyster shell. There is one brood a year in the Northeast, overwintering taking place in the egg stage. The second species infests both deciduous and evergreen euonymus and is also found on pachysandra and bittersweet. When the insects are numerous they literally coat the leaves and stems; infested plants are weakened and may die. The 1/16-inch long female scales are flattened, pear-shaped, and gray-brown in color. The male scales are narrow and whitish.

Oystershell scale, aptly named, attacks many kinds of ornamental trees and shrubs. Enlarged.

Control measures to reduce losses by these two species of scale insects are necessary almost everywhere their host plants are grown. Malathion 50% emulsion used at the rate of 2 to 3 teaspoonfuls per 1

Seale-infested twig of euonymus; large dark scales (arrows) are females, small white scales are males.



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Annoying pest of evergreens, juniper scale, is increasing at an alarming rate. Photo much enlarged.

gallon of water will control the crawling stages of both species of scales. Treatment should be made about June 15 for the oystershell scale and during the first week in July with a repeat treatment in early September for good control of the euonymus scale. A 50% wettable powder used at the rate of 2 to 4 teaspoonfuls per gallon may be substituted for the emulsion.

Juniper Scale

The juniper scale (*Diaspis carueli* Targ.) is one of the most annoying insect pests of ornamental evergreens. It occurs mostly on juniper, but has been reported on red-cedar, arborvitae, and cypress. The insect has increased and spread alarmingly in recent years. Badly infested plants become grayish in color; produce very little, if any, new growth; and soon turn brown, shrivel, and die in part or completely.

Juniper scales live through the winter in an immature stage. The adult form is attained in late April or early May in the Northeast and earlier farther south. The female scale is circular in outline and white in color with a light yellow center. It is more or less convex, and about 1/16 of an inch in diameter.

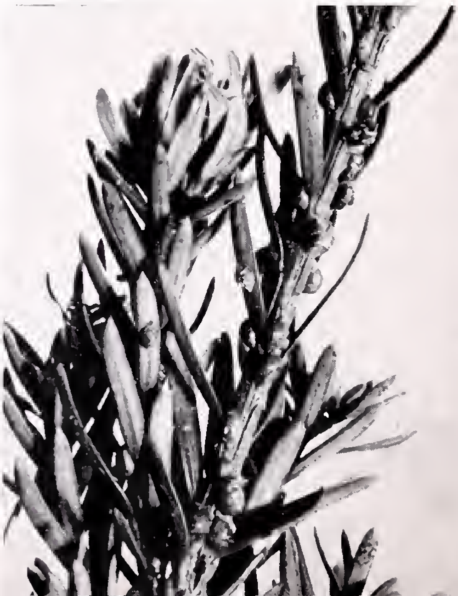
Egg laying commences before the middle of May, and the first young appear late in the month or in early June. By July 1 all or most of the eggs should have hatched, and the young dispersed over the foliage. It is then time to spray with malathion at the rate of 2 teaspoonfuls of emulsion or wettable powder per gallon of water.

Taxus Scale and Mealybug

A soft-bodied scale, *Lecanium fletcheri,* is frequently an important pest of yew (*Taxus*). Certain yews such as Hatfield (*T. media hatfieldi*) and western (*T. brevifolia*) appear to be more susceptible to epidemic outbreaks of the pest than others. Eggs begin to hatch in late June and continue to do so for about 4 weeks. The young scales feed on the new branches and foliage and develop very slowly until autumn. In the following spring feeding is resumed and continues until the scales reach maturity.

A species of mealybug closely related to Comstock's mealybug may be found on nearly any yew. Upright yew (*T. cuspidata capitata*) and western yew (*T. brevifolia*) are somewhat more susceptible to

Taxus scale, an important pest of various species of yew (*Taxus*), slightly enlarged.



attack than others. There are two generations of the pest a year. The crawling stages of the summer brood are present from before the middle of July through early August. The young of the second or fall brood hatch during September. They may or may not disperse from the egg mass during the autumn, but growth does not begin until the following year. On reaching maturity in late spring the females create masses of pinkish eggs which are intermingled with a waxy or cottony secretion. A week or 10 days will pass before they begin to hatch.

Control of both pests may be achieved through the use of several compounds. Dormant miscible oils applied in the spring after danger of freezing weather has passed will kill the overwintering scales and mealybugs. Later in the season newly hatched insects can be controlled with summer oils. Similar results may be achieved with malathion emulsion and wettable powder used at the rate of 2 to 4 teaspoonfuls per gallon of water.

Cottony masses of mealybug are frequently found on species of yew (especially in crevices in bark).

Strawberry and Taxus Weevils

The strawberry root weevil and the black vine or taxus weevil are closely related species that may seriously injure or kill hemlock (*Tsuga*), arborvitae (*Thuja*) and yew (*Taxus*). The larvae of the first species destroy the roots of hemlocks, whereas the adults girdle the twigs of arborvitae. The foliage and roots of yew are damaged by the black vine weevil. It would appear that the latter type of injury is the most serious, resulting in complete loss of many valuable plants during the growing season. Each species has but one generation a year.

Chlordane applied to the soil at the base of the trees as a 5% dust at the rate of 5 lbs. per 1000 sq. ft. of ground area will destroy the larvae and adults of both.

Spruce mite on a spruce needle—its size can be judged from the thickness of the needle.

Mites

Spruce mite, two-spotted mite, clover mite, boxwood mite, azalea mite, and others are perennially responsible for varying degrees of injury to arborvitae, hemlock, blue spruce, azalea, boxwood, lawns, etc. Much of the unsightly damage caused by mites to trees and shrubs in recent years has sometimes followed as a result of the use of DDT and other compounds for the control of insect pests. The insecticides have not only killed the pests but they have likewise destroyed their insect enemies, and those of the mites as well. Consequently injurious species of mites, uninhibited in their development, now appear to be more serious pests than ever in the past.

For years controls applied to mite infestations were somewhat incomplete in their effectiveness. As a result considerable off-colored foliage could be seen almost anywhere throughout the summer months. Fortunately during the past several years specific miticides have been developed which are remarkable in holding down mite populations.

Among the newer miticides may be mentioned Aramite, Ovotran, Dimite, chlorobenzilate, and EPN-300. All of these and others as well may be used to control one or more species of mites.

They may be used on mite infested trees and shrubs as emulsions at the rate of 1 to 2 teaspoonfuls in 1 gallon of water; the lesser dosages for light infestations and the stronger dosages for heavy mite populations. Wettable powders may be substituted for emulsions.

In addition to killing many of the crawling stages of mites, Ovotran also destroys the eggs. Hence this miticide seems to be desirable for general use.

Miticides should be applied to trees and shrubs as required during the spring and summer. Occasionally a fall treatment may be necessary. When insecticides such as DDT are used to combat insect pests, one of the miticides may be included in the spray program. Thus destructive insect populations are retarded and injurious mites are kept under control.

Borers

There are several species of borers that cause die-back of branches and sometimes an entire infested plant. Two of the most common are the dogwood borer (*Thamnosphecia scitula*) and the lilac borer (*Podosesia syringae syringae*). The adults of both species are clear-winged moths. They emerge during late spring and summer and lay their eggs on roughened or wounded places on the bark. In the case of the lilac borer the larvae tunnel under the bark and into the wood, whereas the larvae of the dogwood borer make irregular burrows under the bark on the trunk as well as at the edges of wounds arising from mechanical injury and also around the bases of limbs. There is but one generation of these species a year. The winter is passed in an immature stage. The dogwood borer infests pecan trees in addition to dogwood, while the lilac borer is also found attacking ash (*Fraxinus*), mountain-ash (*Sorbus*), and privet (*Ligustrum*). Treating the bark of plants with a drenching spray of DDT or dieldrin (4 to 6 teaspoonfuls per gallon) about June 1 and again before July 10 and August 20, will help to control the pests.

Damage to dogwood tree caused by dogwood borer.

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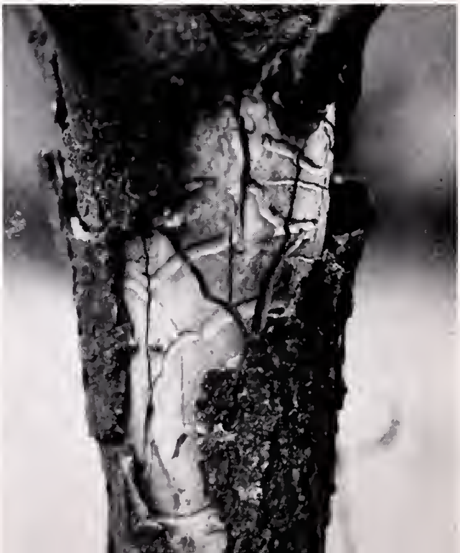
Close-up of dogwood borer damage showing scaling off of bark and burrows of the borers.



PESTS OF GARDEN ROSES

The recognition and control of some of the most important ones

Floyd F. Smith and Edgar A. Taylor

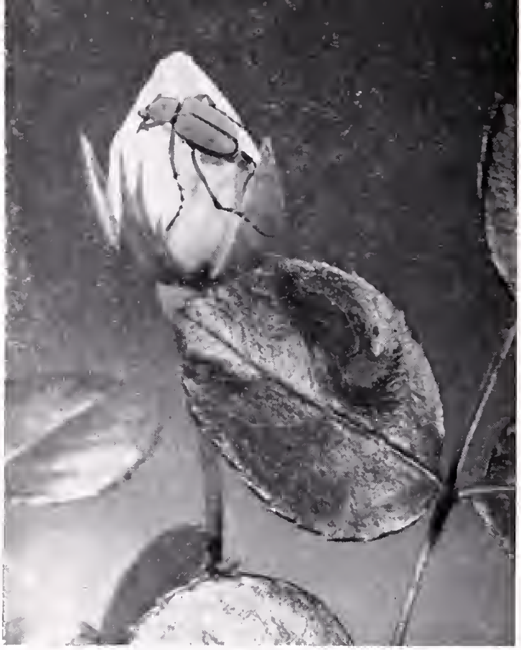
ROSES are attacked by a large number of insects and mites, including leaf-chewing beetles, rose slugs, leaf-cutter bees, sap-sucking leafhoppers, thrips, aphids, scales, spider mites, midges, stem borers, stem girdlers and gall formers. During the last 10 years more effective remedies for these pests have become available.

Japanese Beetles

Japanese beetles feed on rose flowers and foliage during July and August. When few beetles are present, the plants can be protected by hand picking or by frequent applications of 5 per cent DDT dust. In heavily infested areas the use of a cloth covering may be necessary.

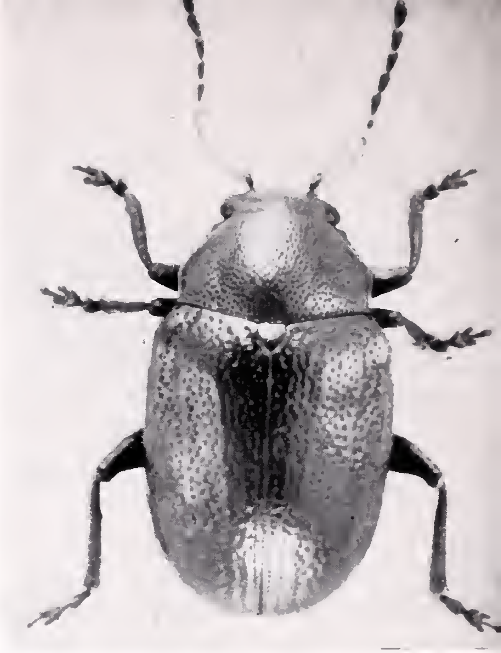
Roche

When not too numerous, Japanese beetles can be controlled by hand picking (also see page 83).



Roche

Rose chafer feeds on tender rose bud.

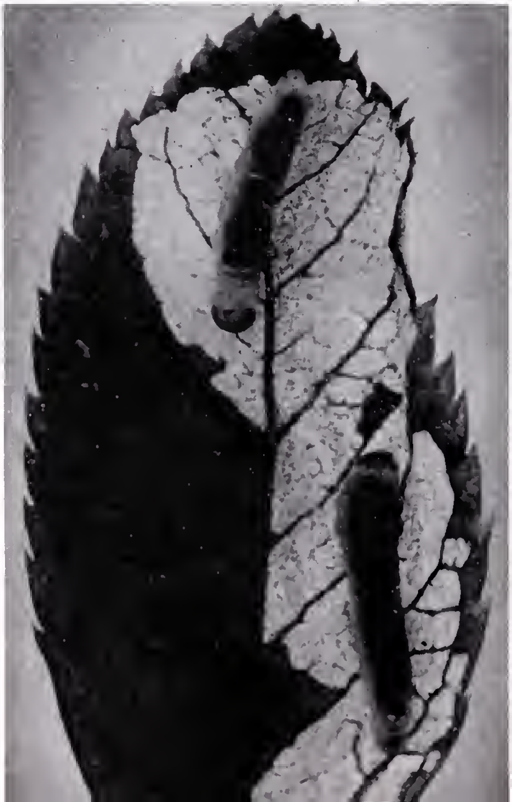


U.S.D.A.

Rose leaf beetle greatly enlarged.

Rose leaf being skeletonized by rose slugs. Enlarged about 4 times.

U.S.D.A.



Rose Chafer

Yellowish-brown beetles with long spiny legs, known as rose chafers, are abundant during June and July in areas with light sandy soil. The beetles develop on roots of grasses and weeds and feed for a short period on rose petals. Dusting with 5 per cent DDT is effective.

Rose Leaf Beetle

The rose leaf beetle is a small, oval, metallic-green beetle, which chews small holes in buds and flowers of roses. The insects are most common in suburban gardens near uncultivated fields, where the larvae feed on roots in the soil. Adults on roses may be killed by dusting with DDT.

Rose-slugs

Three species of sawflies, small wasp-like insects, lay their eggs in rose foliage. Their dark green larvae, known as rose-slugs, skeletonize the leaves or eat out irregular areas. They are readily killed with 5 per cent DDT dust. The treatment must be applied promptly, because the insects appear suddenly and do their damage quickly.

U.S.D.A. photos

Rose leafhoppers, here enlarged about 7 times, cause foliage to appear stippled.

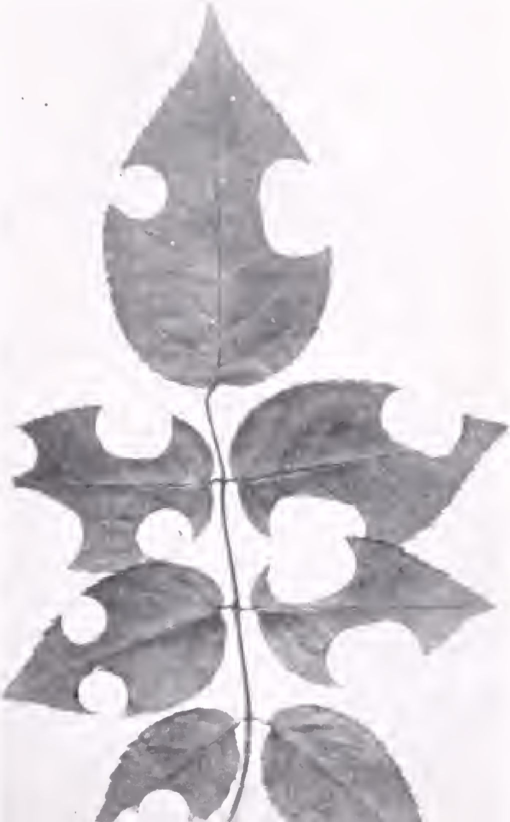
Rose Leafhopper and Potato Leafhopper

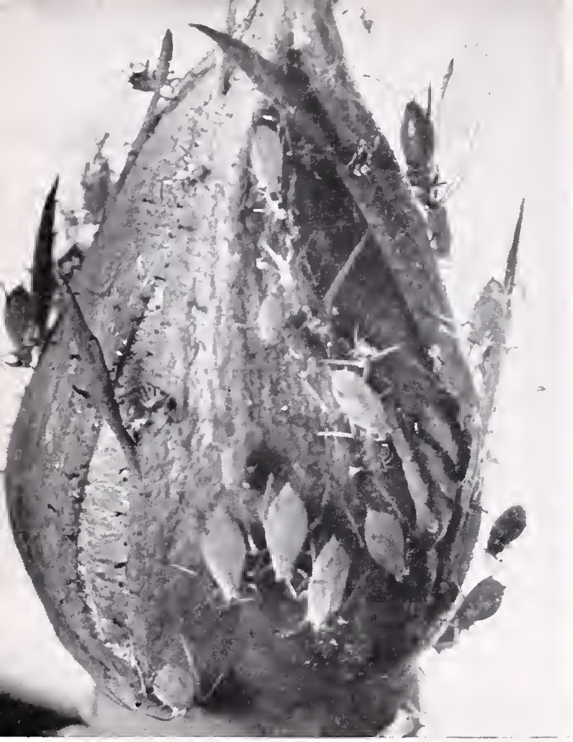
The rose leafhopper, a tiny greenish-yellow jumping insect, is frequently found on the undersides of rose leaves. The insects suck out the contents of the leaf cells, causing a stippling that resembles injury by spider mites. The potato leafhopper, a pale green species, feeds on the veins of tender young rose leaves, causing them to curl and wilt. Dusting the underside of the foliage with 5 per cent DDT will destroy the young nymphs and many of the adults of both species of leafhoppers.

Leaf-cutter Bees

Leaf-cutter bees cut circular pieces of rose leaves and other plants and store them as food for their young in the pith of rose stems. The tunneled stems usually die back for several inches. Carpet tacks pushed into the ends of cut stems at pruning time will prevent the bees from entering the stems. Tree-wound paint can also be applied to the cut stems.

Neat circular pieces are cut from leaves by leaf-cutter bees to line their burrows in rose stems (also see page 83).





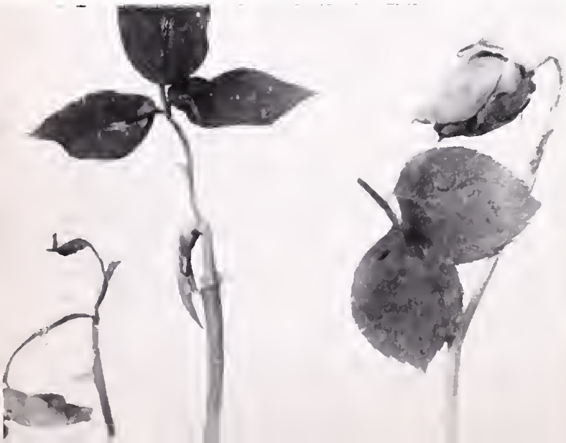
McWhorter

Aphids (plant lice) on a rose bud; winged adult visible at upper right (also see p. 82).

Aphids

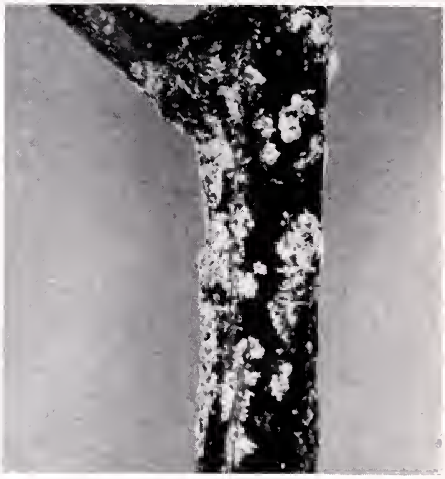
The rose aphid and several other species of aphids occur on stems, leaves, and buds of roses. By sucking the plant juices they stunt its growth. The aphids also secrete a sticky honeydew, which accumulates on the foliage. A spray containing 2 teaspoonfuls of nicotine sulfate (40 per cent) in 1 gallon of soapy water will destroy an infestation. A spray or dust containing malathion is also effective.

Death of stem tips and buds is generally a symptom of attack by rose midge maggots (also see page 86). U.S.D.A.



Rose Scale

Old rose stems sometimes become encrusted with white insects known as rose scales. These insects suck the sap from the plants. Regular use of 5 per cent DDT or malathion dust during the summer will reduce the number of rose scale crawlers. If the scales persist until fall, the severely affected canes can be pruned out and the remaining ones sprayed during the dormant season with ½ cup of white oil emulsion concentrate per gallon of water.



U.S.D.A.

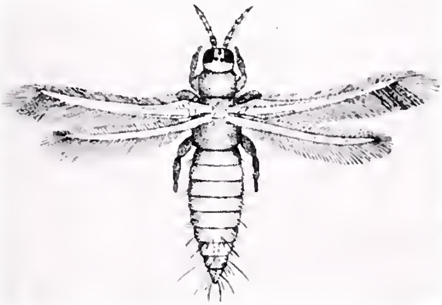
White incrustation on old rose stem is rose scale.

Rose Midge

The rose midge is sometimes a serious pest of greenhouse and garden roses. The tiny yellowish fly lays its eggs at night in the growing tips of the rose stems. The maggots that hatch from the eggs destroy the tender tissue, killing the tips and deforming the buds. The maggots complete their feeding quickly and enter the soil. Frequent cutting and burning of infested tips will destroy many maggots. To prevent reinfestation, the adults emerging from the soil after pupation can be destroyed with 5 per cent DDT dust applied to the plants every 5 to 7 days for at least a month.

Thrips

For several weeks each summer the petals of roses, especially white and yellow varieties, may become brown. The injury is caused by the flower thrips and related species, tiny yellow and brown insects that enter the opening flowers. Several hundred adults can be collected from a single flower by shaking it over a sheet of white paper. The flower thrips breeds in flowering parts of other plants, including weeds and even trees such as the oaks. No fully satisfactory remedy is available because of the daily influx of thrips to the rapidly expanding rose flowers, which cannot be adequately covered with an insecticide. Dusting with 5 per cent DDT or 4 per cent malathion every 2 or 3 days will destroy many thrips as they alight on the flowers. Better protection can be obtained by erecting a cloth covering over the plants or a cloth barrier around the beds of roses and treating the barrier with the insecticide to destroy thrips as they alight on it.



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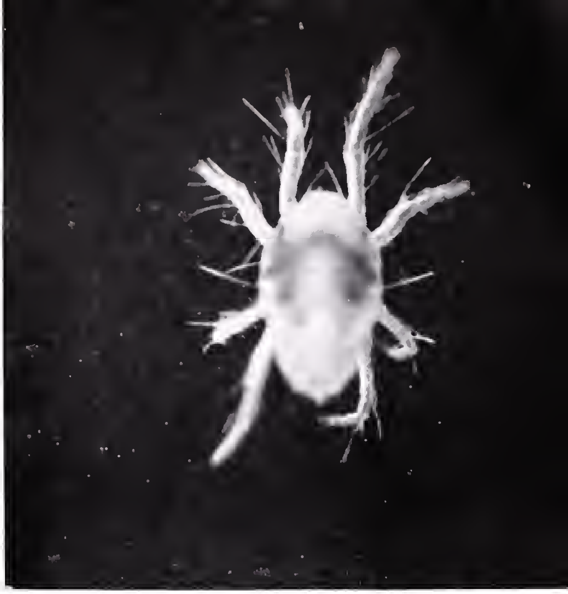
Typical flower thrips, wings outspread. Greatly enlarged.

Spider Mites

The two-spotted spider mite sucks the juices from the leaves, which soon become stippled. As the injury progresses, the leaves turn brown, curl, and drop off. When the mites are abundant they spin a web over the leaf surface. Infested plants are unthrifty. With a magnifying glass these spider mites are seen to be green with two brown spots, but some are dark red. Their spherical eggs are pearly white and glistening. The mites overwinter as eggs on the plant or as adults in trash. They become most numerous in hot, dry weather. Serious injury may be prevented by cleaning up trash and leaves in the early spring, and by making weekly applications of a dust containing 1.5 per cent of Aramite or 4 per cent of malathion. Wettable powders and emulsifiable concentrates containing these miticides are also available on the market and should be used according to directions on the container.



McWhorter

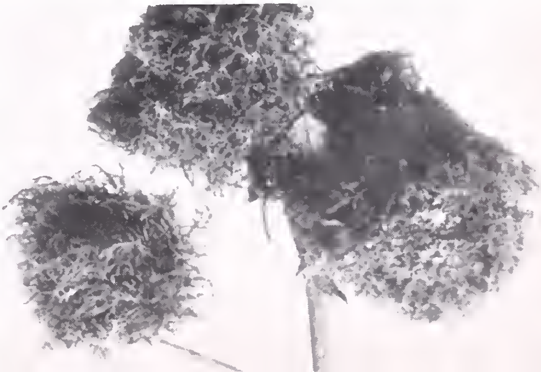
Living two-spotted spider mite magnified about 60 times.

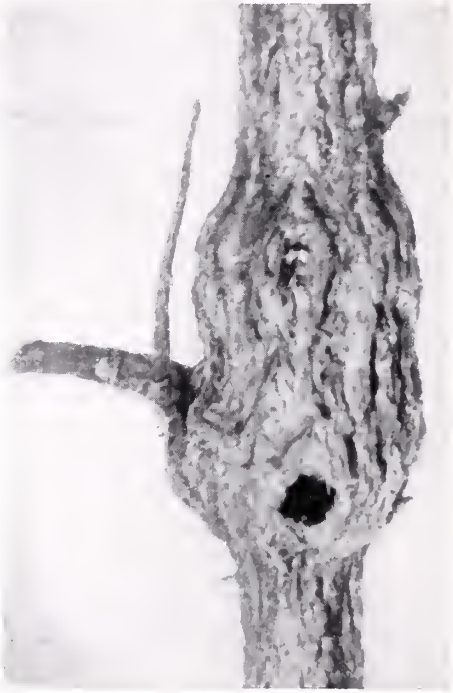
Rose Galls

Several species of wasplike insect lay their eggs in stems of roses, and their

Fibrous, mossy galls on rose stems are caused by one species of small, wasplike insect.

U.S.D.A.





U.S.D.A.

Swelling on rose cane is result of boring by rose stem girdler.

larvae cause large swellings, or galls. One species makes a gall resembling fibrous moss. Another causes a large wartlike gall near the ground surface. Infested stems should be pruned to remove the galls and burned to destroy the insects in the galls before they emerge. No insecticide known will control the insects that produce these galls.

Rose Stem Borers

Several kinds of borers, including the rose stem sawfly, the raspberry cane borer, and the rose stem girdler, occasionally tunnel in rose stems. Infested stems usually die back, and those containing the stem girdler develop a marked swelling at the point of injury. Infested stems should be cut and burned.

Applications of 5 per cent DDT dust at weekly intervals during June and July, when adults of the several species are present, will also help to prevent reinfestation.

General Recommendations for Pest Control

Sanitation is very important in the rose garden. Old foliage and weeds should be cleaned up, because they may become sources of spider mites and leafhoppers. Weedy areas serve as breeding places for rose chafers and rose beetles. It is essential to cut and burn infested stems containing borers, insect galls, and midge-infested tips. In addition to the judicious use of insecticides it may be desirable to protect prized plants and flowers from insect attacks by covering them with cheesecloth or other loosely woven cloth on a light framework.

A good hand duster, a small sprayer, and a few insecticides are necessary for effective pest control. There are several good insecticide-fungicide combinations on the market for control of both diseases and pests. Dusts containing a suitable fungicide together with 1 per cent of lindane and 5 per cent of DDT and either 1.5 per cent of Aramite or 4 per cent of malathion will control most of the pests if applied at weekly intervals as is required for control of black spot and mildew. Nicotine sulfate and Aramite wettable powder should be kept on hand for use as sprays to control any unusual infestations of aphids or mites. The nicotine sulfate is used at the rate of 2 teaspoonfuls per gallon of water to control aphids and Aramite wettable powder at the rate of 4 teaspoonfuls per gallon to control mites. Occasionally a white oil emulsion will be needed to control scale insects.

In handling, mixing, and applying insecticides, special care should be exercised not to inhale the dust, fumes, or vapors. If necessary, wear a respirator approved for protection against the insecticides being used. After working with insecticides, thoroughly wash the hands or any exposed parts of the body. Label containers in which insecticides are stored and place them out of reach of irresponsible persons or children.

Roche

Simple cloth mask protects operator from some of the less irritating spray mixtures while spraying roses.

This respirator gives greater protection against inhaling the more highly toxic chemical sprays and dusts.

U.S.D.A.

FUNGICIDES—PAST, PRESENT, AND FUTURE

Chemicals used against plant diseases

W. D. McClellan

PLANT diseases and their control have been a concern of man from the beginning of recorded history. There are numerous Biblical references to blights, blasts, rusts, and smuts prior to 500 B.C. About this time it was recommended that amurca (dregs) of olives should be sprinkled on plants to prevent attacks by blight (presumably powdery mildew). Homer, about 1000 B.C., referred to "pest-averting" sulfur. Aristotle quotes the observation of a Greek, Cleidemus, on the diseases of the fig, the olive, and the vine. Theophrastus is generally regarded as the father of botany. His *Historia Plantarum* written about 350 B.C. discusses plant diseases including olive knot, fig rot, cereal rust, and others. Plinius Secundus, who lived from 23 to 79 A.D., discussed rust of wheat and barley at length and recommended two methods of control: early sowing of grain so that it will ripen before rust comes on; and the sticking of laurel branches in the soil throughout the field so that rust may go over on these.

Early Control Methods

Only in modern times, however, has the nature of plant disease been understood and sound control measures developed. Early discoveries of fungicidal activity were mainly accidental. Jethro Tull in 1733 said that soaking wheat seed in salt brine for the control of smut originated about 1650, when wheat salvaged from a wrecked ship near Bristol, England, grew free of smut. Prevost in 1807 demonstrated that copper sulfate is effective in controlling wheat bunt. John Robertson reported in 1821 that sulfur is effective for controlling powdery mildew of peach and that it is a specific treatment for this disease.

Discovery of Bordeaux Mixture

Alexis Millardet of the University of Bordeaux was commissioned to study the downy mildew of grapes. In 1882 he noticed that where a mixture of lime and copper sulfate was sprinkled on vines near roadsides to discourage the pilfering of grapes there was less mildew on the vines. He started tests that confirmed his observations. These tests led to the development of the famous bordeaux mixture, one of the best fungicides ever developed and still used widely. The development of bordeaux mixture initiated the general practice of plant disease control by chemicals. Thus chemical control of plant disease came into general use only 70 years ago.

The discovery of bordeaux mixture naturally sparked a search for other chemicals that would control plant disease. H. L. Bolley used formalin for wheat smut in 1897; A. D. Selby introduced formaldehyde soil treatment for onion smut in 1900; Cordley in 1905 reported that lime-sulfur solution would control apple scab; and Riehm introduced organic mercury for wheat smut in 1913.

Until the late 1930's most of the research on fungicides was concerned with inorganic sulfur and copper compounds, their dosages, the injury factor in bordeaux mixture, fixed coppers, effect of particle size in insoluble coppers and sulfur, mode of action of copper and sulfur as fungicides, the use of wettable sulfur and lime-sulfur, etc. Thus research was concerned almost entirely with trying to make known materials more effective.

Organic Fungicides

In the late 1930's a group of plant pathologists under J. G. Horsfall, then at the New York Agricultural Experiment Station at Geneva, began screening a number of organic compounds for fungicidal activity. In 1940 H. S. Cunningham and E. G. Shavelle of this group reported that tetrachloro-para-benzoquinone was fungicidal. This material has since been given the shortened common name "chloranil" and is sold widely as "Spergon" for treating seed, particularly that of peas and other legumes. This report greatly stimulated the investigation of other organic compounds. Within a half-dozen years others were found and many of these were rapidly put into use.

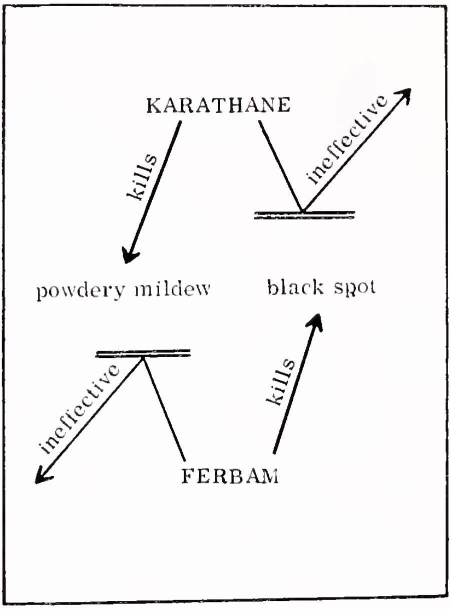
Fungicides such as zineb, maneb, ziram, thiram, ferbam, chloranil, captan, dichlone, and glyodin, all organic chemicals unknown 15 years ago, are now commonly recommended and are rapidly replacing the older inorganic coppers and sulfurs. It has been estimated that by 1950 more than ten million pounds of these new organic fungicides were being used annually. Curiously, some of these compounds were already in use in the vulcanization of rubber and the similarity in the role of sulfur in fungicidal action and rubber vulcanization has been pointed out.

Because many organic compounds that are fungicidal have long, structural chemical names, common names (thiram, zineb, ferbam, captan) have been given them because it is much easier to say "captan" than "N-trichloromethylthiotetrahydrophthalimide"! Common, chemical, and trade names for the more important organic fungicides are given in the accompanying table. The new organic fungicides can be grouped into several classes: phenyl derivatives of mercury such as Puratized Apple Spray and Mersolite-8; dithiocarbamates, organic derivatives of sulfur of which there are three types tetramethyl thiuram disulfide (thiram), metallic methyl dithiocarbamates (ziram and ferbam), and metallic ethylene bisdithiocarbamates (maneb and zineb); chlorinated quinones (chloranil); chlorinated naphtho-quinones (dichlone); glyoxalidines (glyodin); and a phthalimide (captan). There are numerous others that show promise, but those listed are the ones now in extensive use commercially.

Azalea Flower Spot

These new fungicides are used to control some plant diseases not effectively controlled by previously available compounds. For example, azalea flower spot, a serious disease of azaleas in southern gardens, was discovered in 1931 in the gardens around Charleston, South Carolina. Freeman Weiss studied this disease and found that the spores of the causal organism could be spread by insects; that the organism infected only the flowers of azaleas, rhododendrons, and a few other members of the Ericaceae; and that the organism lives from flowering season to flowering season as tiny black sclerotia on the ground under previously infected plants. However, he was unable to control the disease with the then known fungicides. Brierly, Gill, and Childs succeeded Weiss in these studies but they too were unable to secure practical control. In 1944 and 1945 Cynthia Westcott worked on the problem for the United States Department of Agriculture. Among the fungicides she tried were two new ones just then becoming available for experimental use, nabam and dichlone. Both gave good control, which was not previously possible with fungicides. Zineb as well as nabam is now recommended and is widely used in the show gardens in the South to control azalea flower spot. Dichlone is no longer recommended because it frequently injures the flowers.

Some of the new fungicides are quite specific and can be used for controlling one type of disease but are not effective against another. For example Karathane, a dinitro capryl phenyl crotonate, is very effective as a spray for the control of powdery mildews of rose, peach, apple, and chrysanthemum, but it is not effective against black spot of rose. On the other hand, ferbam is very effective against rose black spot and is particularly effective against the rusts of rose, snapdragon, hollyhock, and apple but it is ineffective against powdery mildews. In general, maneb and zineb are effective against a wider range of fungus diseases than are ferbam and ziram. Ferbam and ziram are closely related compounds, the only difference being that ferbam is the iron salt of dimethyl dithiocarbamate and ziram is the zinc salt. They are about equally effective, but occasionally, on some crops, ziram is more effective. *This is due in part to the presence of zinc in the fungicide where plants are being grown in zinc-deficient soils.* Furthermore, ferbam is a black powder whereas ziram is a white powder and is less disagreeable to handle.



The organic chemicals differ not only in effectiveness as fungicides, but also in toxicity to plants. For instance, Weiss, Haasis, and Williamson demonstrated that ethyl mercury phosphate (New Improved Ceresan) is very effective in controlling the destructive fusarium basal rot of narcissus in the eastern United States. The treatment is applied after bulb harvest. If, however, the treatment is applied too soon after harvest, severe flower and foliage injury will be evident the following spring. On the other hand, if treatment is delayed too long after harvest, poor rot control is obtained even though flower injury is avoided. Later, when the writer tried newly developed organic mercury compounds, he found that phenyl mercury acetate (Mersolite-8) or phenyl mercury triethanol ammonium lactate (Puratized Agricultural Spray) was as effective in the control of basal rot as was ethyl mercury phosphate and no flower injury resulted even though the bulbs were dug and treated while still green.

Fungicide Mixtures

Because many of these materials are specific for a certain disease or type of disease or are more successfully used on one group of plants than on another, and because of the diversity of the materials, the home gardener is often at a loss to know which material to apply and when to apply it. Thus, there is need for combinations of materials in one package that will be effective not only against the major diseases the home gardener encounters, but also will be effective against insect pests. The home gardener prefers a "one-shot" mixture for use in his garden. In a search for such a mixture for use on roses, Floyd Smith, Ed Taylor and I have been testing, in cooperation with the American Rose Society, a number of different fungicide, insecticide, and miticide combinations as dusts on roses. We have found that Massey's sulfur-copper combination, a sulfur-ferbam combination, and zineb are all effective in dusts for controlling black spot on roses. Captan as a dust is not as effective for rose black spot. We do not have sufficient information on the effectiveness of these and other materials

NAMES OF NEW FUNGICIDES

Common name	Representative trade names	Chemical name
captan	Captan Fungicide Orthocide	N-trichloromethylthiotetrahydrophthalimide
chloranil	Spergon	tetrachloro-para-benzoquinone
dichlone	Phygon	2, 3-dichloro-1, 4-naphthoquinone
ferbam	Fermate, Ferberk Fermocide Ferradow Karbam Black Nu-Leaf Black	ferric dimethyl dithiocarbamate
glyodin	Crag Fruit Fungicide 341	2-heptadecyl glyoxalidine acetate
maneb	Manzate	manganese ethylene bisdithiocarbamate
nabam	Dithane D-14 Nabam Fungicide Parzate Liquid Thiodow Liquid	disodium ethylene bisdithiocarbamate
thiram	Arasan, Tersan Thiram Naugets	tetramethyl thiuram disulfide
zineb	Blightox Dithane Z-78 DuPont Fungicide A Parzate Thiodow Powder	zinc ethylene bisdithiocarbamate
ziram	Karbam White Niagara Z-C Dust Opalate White Fungicide Zerlate, Zirberk	zinc dimethyl dithiocarbamate

on powdery mildew. All are compatible with the insecticides DDT, lindane, Aramite, Ovotran, and malathion. L. M. Massey at Cornell has also been interested in combinations of materials for the back-yard rose grower.

At present there are on the market a number of "one-shot" mixtures, some of them good and many not so good. Not many contain a miticide, which we consider to be very important in certain locations. Also many of the commercial "rose sprays," "garden dusts," "flower bombs," etc., contain only an insecticide and are not "one-shot" mixtures as the name implies. A good guide to the usefulness of these mixtures is the directions on the label of the container. Strict federal laws govern the wording on labels of pest control materials. Many states have similar laws. The label must list the active ingredients and their amounts. It must also give dosage rates for application and the pests that can be controlled. If the material is poisonous or hazardous that also is so stated. Thus by careful reading of the labels on containers of fungicides and insecticides the home gardener can usually decide for himself whether the preparation can be expected to do the job he wants it to do. Naturally, the writers of these labels are willing to state what their material will control but not what their material will not control. Consequently if the home gardener is interested in the control of a leaf spot and the label of a certain material lists a number of insects that can be controlled but does not mention any disease, he should look for some other material for controlling his leaf spot.

Future Prospects

What of the future? At present there is no easy sure cure for plant diseases. We have no effective, easily applied materials that will control soil-borne diseases, for instance. True, chloropicrin (tear gas) is very effective against many soil-borne diseases as well as weed seeds, nematodes and soil insects and it has been used extensively for their control. However, it is disagreeable to use, hazardous to plants growing nearby, and expensive, and to be effective must be used under optimum conditions. Formaldehyde is also effective and can be used readily on small amounts of soil prior to planting, mainly for damping-off control. It too is far from satisfactory. Methyl bromide is coming into more extensive use for disease control, but it is a highly poisonous gas that must be handled as such. The materials sold as D-D (containing dichloropropene and other hydrocarbons) and as EDB (ethylene dibromide) are very effective against soil nematodes but are not effective against fungus diseases. These must be applied before planting. None of these soil-treating materials can be used successfully around growing plants. No doubt the future will provide us with desirable, effective fungicides for soil application but the immediate prospects are not very good.

Chemotherapy

A great deal has been written about chemotherapy for the control of plant diseases. In fact more has been written about chemotherapy and chemotherapeutants than has been accomplished. The idea behind chemotherapy is to immunize plants against disease or to cure them of disease by applying chemicals to the soil, by injecting chemicals into the plants, or by applying them to the foliage. Such materials are then distributed throughout the plant, rendering it immune from the disease. This is very intriguing and appeals to the layman as an ideal method of disease control. The development of systemic insecticides since World War II has opened up a very promising field of research for entomologists. Chemotherapeutic control of insects has been achieved by the application of demeton and schradan to the soil, to seeds, and to the foliage, thus causing such treated plants to be toxic to insects; this is certainly a valuable new field of pest control. To date, practical control of plant disease by chemotherapy has not been obtained with any of the materials tested. Some reduction of disease development by a few chemicals has been accomplished either by antidoting the toxin produced by the disease organism or by inhibiting the growth of the disease organism. Plant pathologists still have a long way to go to achieve practical success.

The problem of the plant pathologist is a little different from that of the entomologist. Both the entomologist and the plant pathologist are concerned with controlling pests of plants. However, the entomologist is concerned with pests that are members of the animal kingdom, whereas the plant pathologist is concerned with fungi and bacteria, members of the plant kingdom. Thus, a material that will kill or inhibit the growth of the disease organism may also be expected to have adverse effects on the host plant because of their close relationship. I do not wish to imply that it will be impossible to secure effective chemotherapeutants for the control of plant diseases; in fact, I believe such a possibility is good. It may be that effective materials will be found among the antibiotics.

Antibiotics

In 1944, J. G. Brown reported that crown gall could be killed by injecting the galls with streptomycin or penicillin. Since that time there has been a great deal of research on antibiotics for plant disease control; one, actidione, is in commercial use and another, streptomycin, had large-scale tests this year. Actidione has been tested extensively on roses for powdery mildew control. However, it has usually been too injurious to the rose plants to be recommended. The most striking results with antibiotics for use against plant disease have been with bacterial diseases which had not previously responded readily to control. Streptomycin has been very effective in controlling halo blight of beans—a bacterial disease—according to W. J. Zaumeyer and others. On beans it acts as a true systemic; it is absorbed and translocated through the stems and foliage of bean plants. Streptomycin has also given excellent control of the fire blight of pears and may come into extensive use on pears, apples, and even ornamentals such as pyracantha and cotoneaster that are subject to fire blight. Robinson, Starkey, and Davison just reported control of bacterial wilt of chrysanthemum by treatment of the cuttings with streptomycin. At present antibiotics are more expensive than other fungicides, but their low dosage rate makes them feasible. As little as 1/56 ounce of an antibiotic in 100 gallons of water is sufficient to give disease control in some instances.

Thus, the future gives promise of more effective disease control for the home gardener. This will probably come about through the development of effective treatments for soil-borne diseases, more efficient spray and dust materials, and treatment of seeds, cuttings or plants by antibiotics or chemicals to render them less susceptible or even immune from attacks by fungi or bacteria. Coupled with this development will be the development of varieties of ornamental plants that will be more resistant to disease attacks. Most of these changes will not happen immediately but, as in the past, gradual improvement in disease control will take place. Today disease control materials and methods are far superior to those of only 15 years ago. For the immediate future I believe we shall see more effective use of new insecticides and fungicides in combination mixtures by home gardeners. These mixtures will include the new organic fungicides and insecticides which are less toxic to plants but which are more effective than materials formerly available.

* * *

EDITOR'S RECOMMENDATIONS FOR HOME-MADE BORDEAUX MIXTURE

For 3 gallons of an 8-8-100 formula:

Dissolve 4 ounces (about 7 level tablespoonfuls) of copper sulfate (bluestone) in 6 quarts of warm water by suspending in a cheesecloth bag near the top of the water in a nonmetal container.

Dissolve 4 ounces (about 15 level tablespoonfuls) of a good spraying grade of fresh hydrated lime in 6 quarts of water and allow to soak for 30 minutes.

Add the copper sulfate solution slowly to the lime solution, stirring continuously. Pour into sprayer through cheesecloth. Use mixture immediately and rinse out sprayer afterwards.

If a wetting or sticking agent is used, mix it with a small amount of water first, then add slowly to the bordeaux mixture, stirring meanwhile.

Richard Averill Smith

An adequate program of spraying and dusting will pay for itself in vigorous plants, beautiful flowers, and a sense of satisfaction to the gardener.

SPRAYING AND DUSTING ROSES FOR DISEASE CONTROL

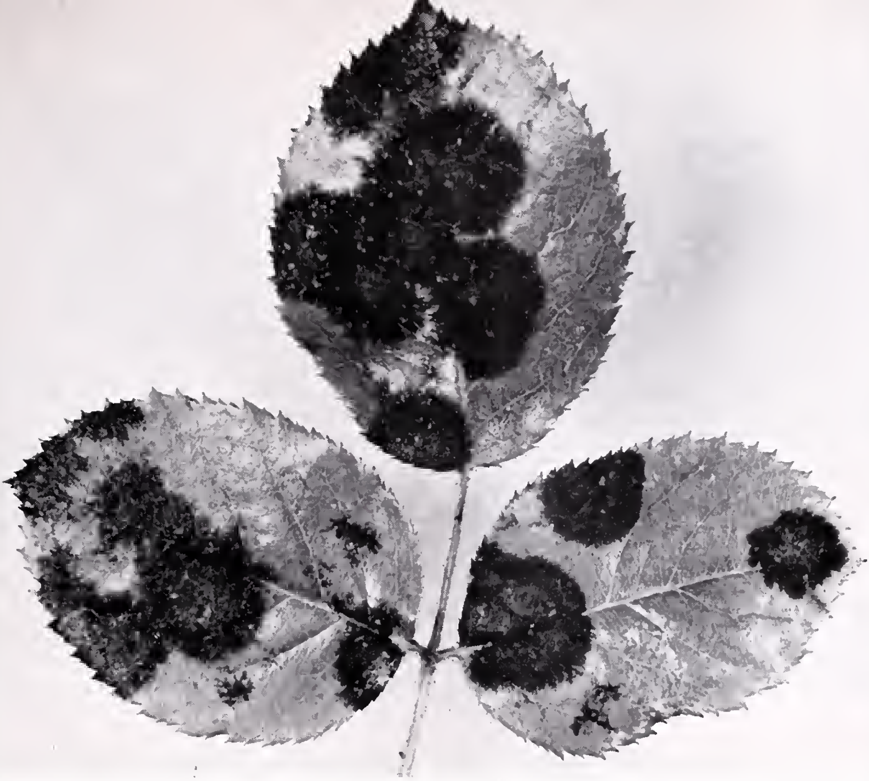
How to recognize and combat the four most serious rose diseases

L. M. Massey

GARDENERS interested in growing roses, and in having the plants and blossoms at their best throughout the season, soon learn that in most areas it is necessary to employ, through the use of sprays and dusts, a program of protection against diseases and insect pests. Resistant varieties are too few for the gardener to attempt to limit his plantings to them alone.

The prevalence and severity of disease depends largely on the climate, seasonal variations, and varieties selected. What favors one disease may be unfavorable to another, so that no one material or procedure is satisfactory for treating all. If the garden is located in northeastern United States, or in a section with rainfall similar in amount and distribution, black spot will be the most common and serious disease with which to contend. On the West Coast the chief trouble may be rust or mildew, or both, with black spot entering the picture on occasion. Seasonal variations in weather may present a changing situation from one year to the next and from one geographical area to another.

Disease occurrence and severity are relative matters. Fighting disease successfully adds to the pleasure of growing roses. The challenge is intriguing and if the gardener will accept disease and insect pest control as one of the numerous problems to be met, he will have fun and feel a sense of accomplishment in doing it. The final details of procedure can be developed best in his own garden.



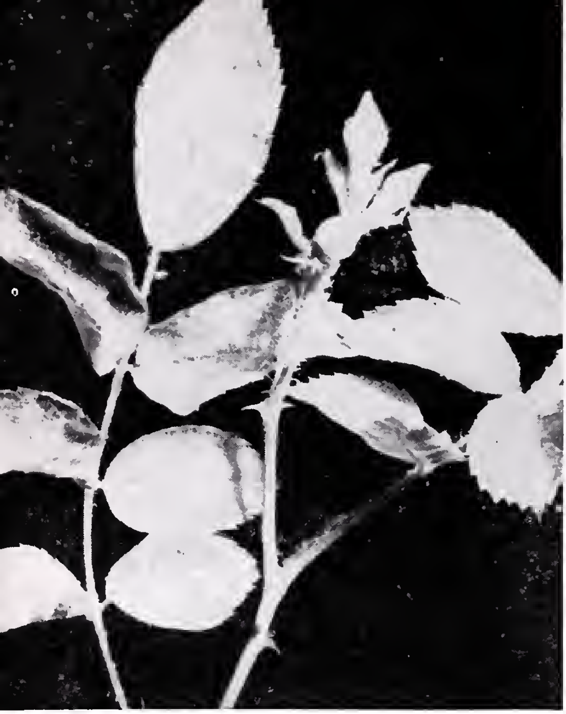
McWhorter

Typical appearance of black spot on rose leaf.

The Diseases

The most serious disease all over the country is **black spot.** It may be recognized by the black spots on the foliage, by the yellowing of affected leaves, and by premature defoliation. The spots may be as much as a half inch or more in size, and when present in numbers may cover the entire leaf surface. They are found largely on the upper sides of the leaves. They have "feathery" margins and frequently yellowing of the tissues is associated with the spots. Premature defoliation varies with varieties and with seasonal weather. It is usually conspicuous. Spots on the stems are often overlooked but they are important in that the fungus causing the disease may live over the winter in this way.

The black spot fungus (*Diplocarpon rosae*) is known to occur only on roses. In areas of cold weather where the plants go dormant in the winter, the fungus hibernates in the old diseased leaves on the ground, as well as in lesions on the stems. In the spring there are two kinds of spores produced: one a so-called winter (sexual) spore in the spots on the old infected leaves on the ground; the other, a summer spore produced both in the overwintered leaves and in the stem lesions. There is evidence that the summer spores from the stem lesions are more important in causing infection of the leaves in spring even though the winter spores are shot into the air when mature and thus are in position to be wind-borne. Water is essential for the summer spore dissemination, germination, and infection. Whenever the leaves are wet continuously for 6 or more hours, conditions are favorable for infection.



Westcott photos

When heavily infected with powdery mildew, rose leaves and stems may be entirely covered with white, velvety fungus.

Powdery mildew occurs wherever roses are grown. It may make the plants unsightly and can, under favorable conditions, cause severe injury. All aboveground parts of the rose may be affected, with the leaves being most seriously attacked. Raised, blister-like areas on the young leaves may become covered with a white, powdery, fungous growth, the powdery appearance being due to large numbers of spores. Growing leaves may become twisted and misshapen. With age, the affected areas may become dark in color and be mistaken for black spot lesions. Young growing tips frequently are completely covered, dwarfed and curled, and in severe cases, killed. Infected buds may not open.

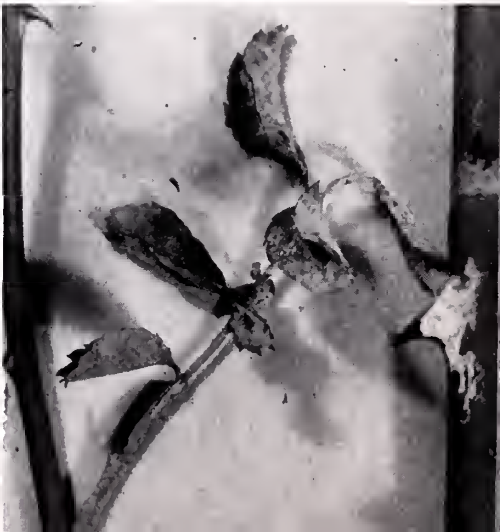
Varieties differ greatly in their susceptibility to mildew with such old sorts as Crimson Rambler and Dorothy Perkins heading the list. Susceptibility to powdery mildew was an important item in their loss of popularity. In fact, few of the reportedly resistant varieties escape when conditions favor infection.

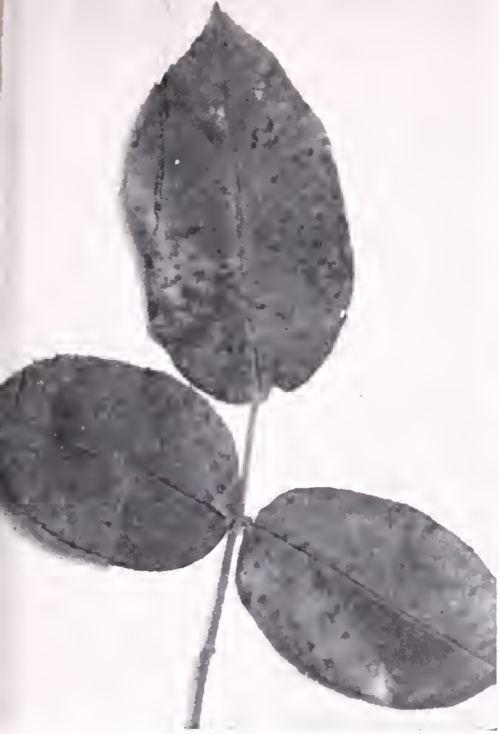
Reasonable doubt exists as to whether or not all of the powdery mildew on rose is due to one organism. The fungus *Sphaerotheca pannosa* var. *rosae* is usually designated as the cause and will serve our purpose here, although other mildews—for example, those on peaches and apricots—may infect the rose.

The white patches of fungous growth seen on the affected parts consist of slender white threads with numerous branches that form a network over the surface. These threads are anchored to the cells of the plant from which the fungus gets water and nourishment. Great numbers of colorless spores are produced in chains. These spores are easily detached and carried away by air currents, thus assuring their dissemination. The disease is favored by high humidities rather than by liquid water as is the black spot fungus. An ideal combination of weather conditions favoring powdery mildew development is that of warm days and cool nights, resulting in high humidities.

Like many other fungi, the mildew fungus produces a special spore form during the winter that can live over to start infection early on the following season's growth. The fungus may also hibernate in the leaf buds where it is somewhat protected by the scales. As the weather warms in the spring and summer, the thin-walled summer spores are better able to survive and, with high humidities, germinate and cause new infections.

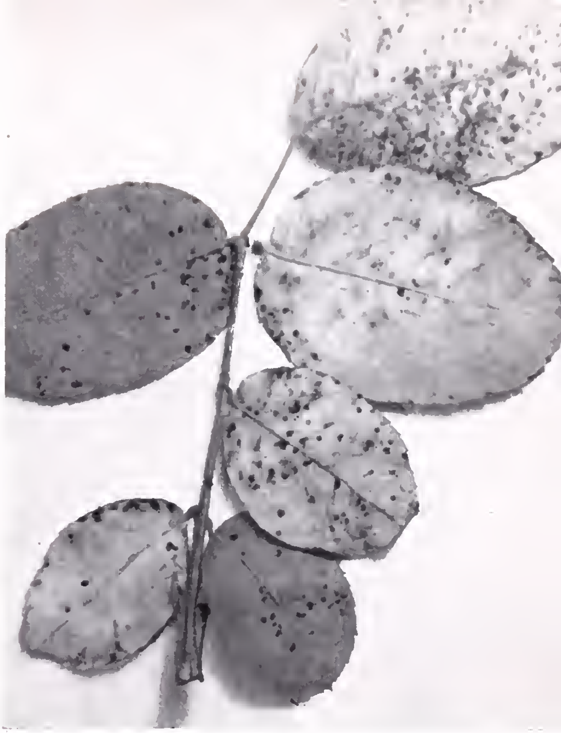
A lighter infection of powdery mildew showing twisted leaves and cottony mold on thorn.





Westcott photos

Upper surface of rose leaf infected with common leaf rust.



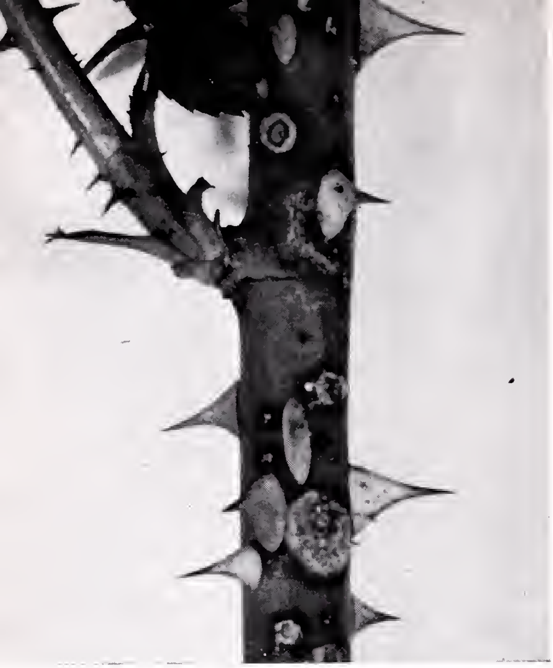
Pustules of rust on under surface of rose leaf are recognized by their reddish-orange color in summer.

Common leaf rust of roses is prevalent on the West Coast and, through both disfigurement and defoliation, does a lot of damage. Under favorable conditions it may rival the injury of black spot in the East. It occurs only on roses. Most of the hybrid teas and climbing hybrid teas grown in this country probably are susceptible. The disease is known to occur in a few gardens in the East but is not of general occurrence here as it is along the Pacific Coast, in England, and in parts of Australia.

Like black spot and mildew, common leaf rust of roses affords a good example of the importance of weather conditions in determining the range and importance of a disease. It is probable that the fungus is regularly sent east and elsewhere in the country on diseased plants from the nurseries but for the most part it soon dies out because of unfavorable weather. However, its persistence in certain gardens is reason for some concern.

Common leaf rust of roses is caused by the fungus *Phragmidium mucronatum.* This fungus has a number of spore forms in its cycle. It is most important and conspicuous in its summer stage, when it can be recognized by reddish-orange pustules on the undersides of the leaves. These pustules consist of a powdery mass of summer spores. The infected leaves may wilt soon after infection and in any case soon fall to the ground. In late summer and early autumn the orange-colored spores are replaced by black ones that are thick-walled and able to endure the winter weather. With the coming of spring these hibernating bodies germinate to produce other spores which in turn infect new leaves, and from these lesions the reddish-orange or summer stage is produced. Cycles of the summer stage reinfect the rose.

Water is favorable for dissemination and infection of the leaves by the fungus. Dry weather prevents its spread while rain, dew, or fog aids in its dissemination. The occurrence and seriousness of this disease depend upon the severity of the winter weather and upon the availability of water at certain times.



Westcott

Brown canker on rose canes; dead areas have purplish borders (also see page 73).

Of the several canker diseases of the rose, **brown canker** is probably the most destructive in the United States. It is restricted to roses, attacking the teas, hybrid teas, polyanthas, and hybrid perpetuals. Doubt exists as to the resistance of any class, variety, or species. All parts of the plants may be affected. Cankers are commonly formed on the stems; they typically have central dead areas, raw umber in color, surrounded by reddish-purple borders. The stem may be girdled by the cankers with resultant death of the parts above, producing a "die-back" condition. Leaf spots are usually purple at first, and later have white central regions. Tiny black dots, the fruiting structures of the fungus, can be seen over the surfaces of the cankers and the centers of the leaf spots.

The canker fungus, *Cryptosporella umbrina*, overwinters in the lesions on the stems and perhaps in other dead parts. Both summer and winter spores can be found in the affected parts the year round, and are present in spring to initiate new infections. The spores are liberated and spread by splashing, dripping, and wind-blown rain. Infection may occur through wounds or through the uninjured surface of the plant. Epidemics of brown canker are frequently associated with injury to the canes from frost, hail, and careless pruning.

Black spot, powdery mildew, rust, and brown canker are the most important rose diseases in the United States. If you have trouble with rose diseases, it is probable that one or more of these four will be involved. But one must be certain in his diagnosis if he is to proceed to best advantage. There are a number of other diseases and injuries from insect pests that complicate the identification. If doubt exists, it is suggested that the gardener send specimens to the plant pathologist or entomologist at his State Experiment Station. These workers will be glad to diagnose the trouble and advise on control.

Control of Rose Diseases

The simple facts given of the life histories of the fungi causing these diseases comprise about the minimum of information needed by the gardener for the intelligent application of control measures. The principle of control is that of protection—the prevention of infection.

Let us assume that the garden is located in New York State or elsewhere in the Northeast. The major disease is almost certain to be black spot with some mildew and canker. There will be a number of insect pests—Japanese beetles, mites, aphids, thrips, midges, chafers, and others.

The disease that is going to require the most attention is black spot. If no protection is given the plants, the spots will be present on the leaves about the time the first ones reach mature size, and in a season of normal rainfall, will increase and result in severe defoliation. So, the first application of protective chemicals will have to be made early in the season, soon after the first leaf buds open, to protect the plants from the season's initial infection. At Ithaca, New York, this first application must be made about May 15, in an average season—otherwise spots will be seen by June 1.

Knowledge of the life history of the fungus gives further guidance. As already mentioned, water plays an important role. Spores are produced under moist conditions, are disseminated by water, require water for germination and infection. When unprotected leaves are wet continuously for as long as 6 to 7 hours, infection will result if spores are present. This means that the fungicide must be present on the leaf while it is wet, or very soon thereafter; and in actual practice, it means that the plants must be sprayed before rain.

An early beginning is very important since the battle is always an uphill fight if the disease gets started. Additional applications must be made on the average at about weekly periods throughout the season, in order to replace material dissipated by rains and particularly to cover and protect new growth. Young leaves enlarge as they get older and new ones form, making new surfaces to be covered. Obviously, during the spring and autumn, when rains are frequent and new growth is rapid, applications will have to be made oftener than during the summer when growth is slower and rains less frequent. The gardener should keep in mind that he can upset the schedule by the injudicious use of the hose. Overhead watering is safe only if done at times when the leaves will be dry within a 6-hour period. Applications should continue into the autumn, until frost has killed the foliage.

Faulty timing is the cause of most failures and there is no known material that will hold the disease in check without consideration of the times when it is applied. So if he fails, the gardener should not blame the material without first examining the schedule of applications.

This black spot control procedure sounds exacting, and it is. However, when effective control has been obtained, the gardener can ease off a bit provided he is careful of what is brought into his garden. The black spot fungus frequently is brought into a garden on plants from the nursery. Further, the black spot program will be adequate for powdery mildew and rust, and will help with the canker control problem. Insects can be controlled by adding the proper insecticide at the right times.

Because of the speed and ease with which **dusting** can be done, this method of protection offers much to the gardener as a supplementary procedure, if not the main one.

There are numerous **materials** available to the gardener for use on roses, and additional ones are being offered from time to time. The trend in recent years is toward organic materials as substitutes for the older, simpler chemicals such as sulfur and copper. These newer materials have their good points but in general are more specific — controlling one disease but not another—and uncertain in their behavior.

Another trend in spray and dust materials is the compounding, sale, and use of multi-purpose mixtures. These are mixtures of one or more fungicides, plus one or more insecticides, with adjuvants for wetting the foliage and causing the chemicals to adhere. The gardener may want to add some favorite material of his own, including some of the new soluble fertilizers, resulting in something of unknown composition. When such a complex mixture fails to give satisfactory results, it is difficult to determine why.

The multi-purpose mixture is favored for the small home gardener where cost of material needed is not a large item at best, and where the gardener wants to get along with the minimum of effort and information. For the large planting, the expense of the multi-purpose mixture may be prohibitive and the gardener more disposed to understand diseases and pests, and their control, well enough to both diagnose and prescribe for them —and enjoy doing it.

In the past, reasonable success was had through the use of materials containing sulfur and copper for diseases and arsenate of lead, nicotine, pyrethrum, and rotenone for insect pests. It was through the experimental use of these relatively simple chemicals that the feasibility of disease and insect control in the rose garden was demonstrated. However, these materials had their faults, mostly those of causing injury and discoloration, so that both the gardener and the investigator were receptive to new materials that seemed to offer promise. DDT for insects and soon Fermate for diseases, led a large list of organic chemicals that offered advantages. Testing continues, and new compounds are being offered by the chemists and biologists. Now the gardener has a choice of a number of good materials and should be able to find something to his liking, although it will not be perfect. Among these promising fungicides are ferbam, zineb (Dithane Z-78 or Parzate), manzate, Phygon, copper-containing materials such as basic copper sulfate and other so-called "insoluble coppers," captan, and others. All of these control black spot under the right conditions; some will also control powdery mildew and rust.

For **rust**, it would be well to include ferbam, if it is not being used for black spot control—a mixture of ferbam and sulfur has been demonstrated to be effective against rust. Sulfur and copper are effective against **mildew**, while a new material—Karathane (Mildex)—has been showing up well in recent experiments and may have superior qualities although it is ineffective against black spot.

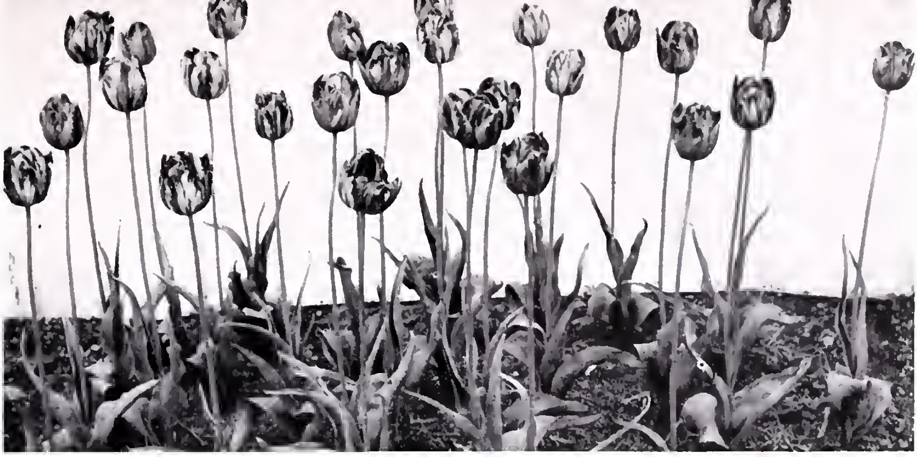
For **canker**, most of the spray and dust materials will reduce infections of leaf and stem but their use should be accompanied by a vigorous eradication program in which all cankers and dead parts in general are cut out regularly and burned.

Attention should be given to so-called **wetting agents** that assist in wetting the waxy surface of the rose leaf. In the case of mildew, the growth of the fungus on the surface is oily in character and will not be killed by the fungicide unless it is wet and penetrated by the liquid. Such detergents as Dreft, Tide, etc. are readily available and commonly used.

Further testing both by the investigator and the gardener is necessary before we know the good and bad qualities of the new fungicides. No one material will satisfy all, and the gardener has to learn how a material or mixture of materials behaves in his own garden, as he applies it. Only a suggestion to proceed cautiously with new materials can be made here, with attention called to the help available from the plant pathologists and entomologists at one's State Agricultural Experiment Station.

Bellows duster is easy to handle and gives good coverage for dusting roses.

Westcott



Buhle

Striping of tulip flowers is caused by a virus disease, and is called "breaking" in reference to the change from solid color to variegated color.

BULB DISEASES

Their causes, symptoms, and cures

Charles J. Gould

ORNAMENTALS grown from corms and bulbs are among the easiest plants to raise and to keep free from serious diseases if they are provided with suitable cultural conditions. They are rarely attacked by mildew, seldom have rust, and most types are not bothered by the wilt fungi. However, there are some diseases of which home gardeners should be aware. Before we discuss bulb troubles in detail, a few general suggestions are in order.

General Precautions

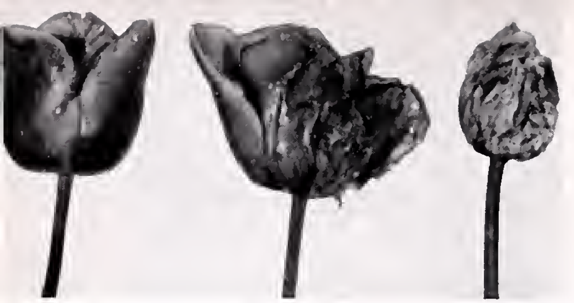
Bulbs and corms may be rotted by fungi and bacteria. Commercial growers now use special disinfecting dips for control of these diseases, but it is usually more practical for the average home gardener to purchase new bulbs than to go to the expense and trouble of treating his own. Bulbs should always be purchased from reputable dealers. Be wary of "bargain" sales.

Root rots are prone to develop under unfavorable growing conditions such as waterlogged or excessively heavy soils. Bulbs require good aeration and a comparatively loose soil of medium fertility. Bulbs should be moved periodically from one area to another to lessen the danger of attack by soil-borne organisms.

Severely diseased plants should be removed to prevent spread of the causal fungus, bacterium, or virus to adjacent healthy plants. This suggestion does not apply to plants slightly affected with leaf spots which often can be controlled by spraying.

Home-made bordeaux mixture is still one of the best fungicides for bulbs, but it is a nuisance to prepare. (See p. 35). The dry package bordeaux preparations are less effective. Certain new fungicides may be substituted in some cases. Usually the general or chemical names for these have been used in this article because they are sold under many different trade names. Wetting and sticking agents should be added to the sprays to wet bulb foliage. Directions on the packages should be followed.

Mottling of the foliage is often caused by a virus which may be transmitted by aphids. Affected plants should be removed. Although spraying with an aphicide is sometimes beneficial, it is not usually practicable for the home gardener.



Author photos

Left to right, light, medium, and severe Botrytis blight on tulip flowers. (Also see page 70).

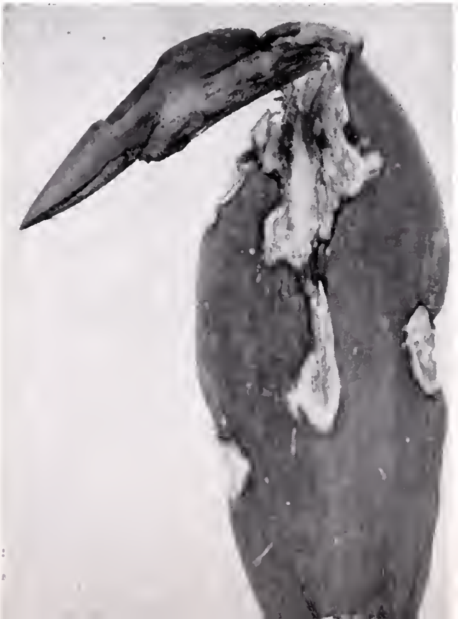
Tulips

Brown spots on leaves and spots on flowers of tulips are common all over the United States. Such spots are often covered with a grayish-brown fuzz. The disease, called **Botrytis blight** or **fire**, is caused by a fungus that overwinters sometimes on bulbs but most often on old stems and leaves. Consequently, all debris should be removed and burned at the end of the growing season. As an additional precaution, the tulips should be dug and replanted in a new location every 2 years. If the location cannot be changed nor the bulbs dug, then the upper inch of top soil around the plants should be removed and replaced with fresh soil. The area should afford sufficient air movement to keep moisture around the plants at a minimum, since high humidity favors the fungus. Finally, in areas where the disease is common, the plants should be sprayed or dusted at 10- to 14-day intervals, beginning when the shoots are about 4 inches high. Ferbam has given us good control of this disease when applied regularly. Directions on the package should be followed. Diseased shoots, heavily spotted leaves, and all withered flowers should be carefully removed and destroyed.

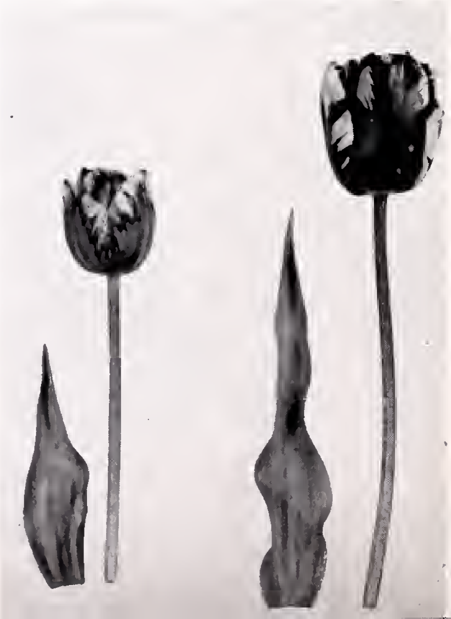
The interesting Rembrandt tulips are actually affected with a virus disease. Common names for it are **mosaic** and **tulip "break."** Colored flowers are streaked with different colors in various patterns. Leaves are usually mottled. Although some people prefer this type of tulip, the disease causes a decline in vigor and may eventually kill the plant. Consequently, growers of Rembrandt tulips should expect to replace them at intervals. Solid-color types and Rembrandts should not be grown in the same garden. Affected plants should be removed from solid-color plantings and other plants sprayed with an aphicide to control aphids which transmit the virus. Lilies and tulips should be planted separately since some commercial lilies carry virulent types of tulip break virus.

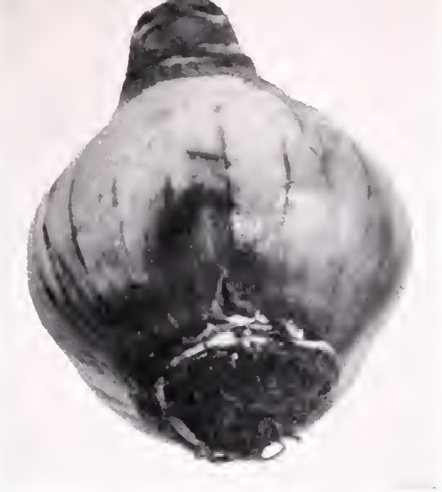
Bulbs may be rotted by parasitic fungi but usually bulbs are predisposed to de-

Botrytis blight also causes spotting and even large dead areas to appear on tulip leaves.



Close-up of "broken" tulips. Darwin tulips infected with the tulip break virus are called Rembrandts, other names are given to other kinds of tulips when virus-infected.





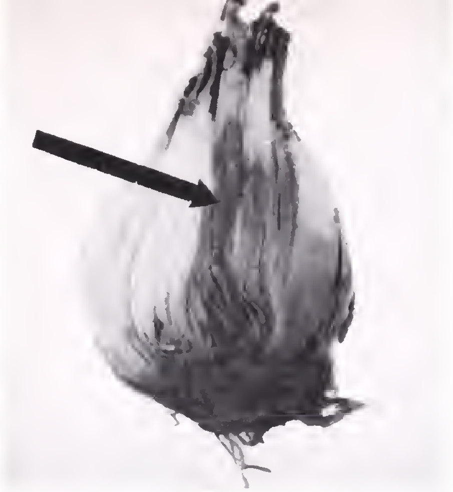
Author photos

Surface view of narcissus bulb with basal rot.

cay by waterlogging or poor aeration of soil, excessive nitrogen, excessive rainfall or irrigation late in the growing season, or rough handling. The rotted area often becomes chalky. Avoid the unfavorable conditions mentioned before, handle carefully, cure properly, discard affected bulbs, and avoid storing under moist and poorly aerated conditions.

Narcissus

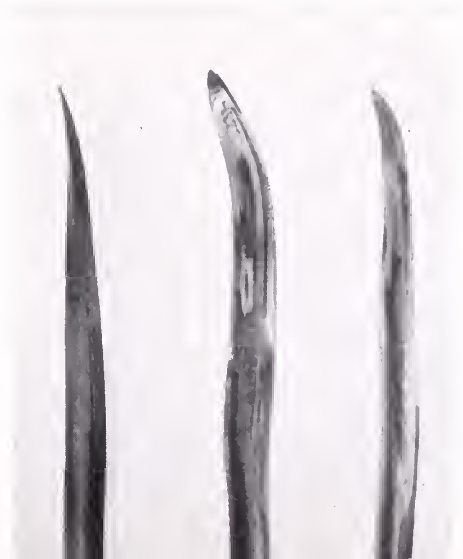
The most common diseases affecting narcissus (daffodils) are the leaf spot type caused by fungi. There are several kinds including **white mold** (a brown spot covered with white mold), **scorch** (short or long, narrow, brown, corroded streaks), and **fire** (brown spots, sometimes covered with a light gray fuzz). Some spots are more common in certain regions than in others. Fortunately the control of these leaf spots is similar. Periodically, bulbs should be dug and cleaned since the causal fungi can survive on the bulb scales. Bulbs should be planted in a new and well aerated location. Spray at 2-week intervals, beginning when the disease first appears. Copper compounds, particularly homemade bordeaux mixture, have given good control. Zineb has also been recommended. Remove flowers at the end of the blooming season, and remove and burn leaves and stems at the end of the growing season.

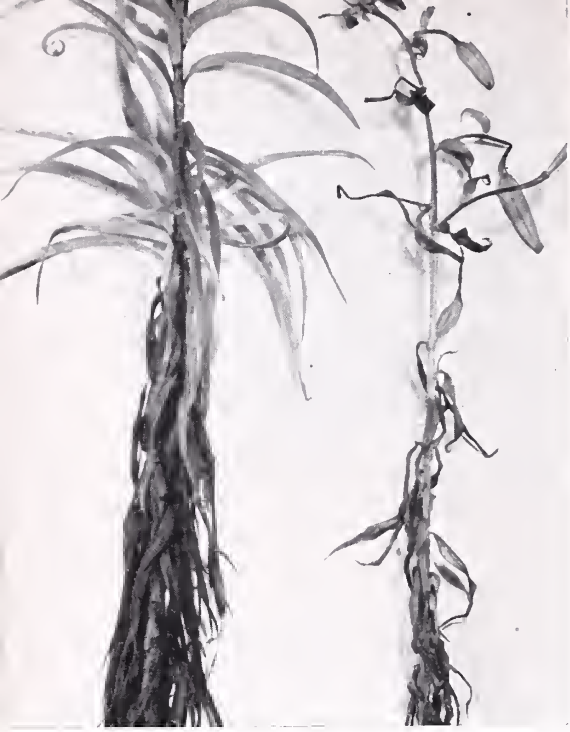


Section through narcissus bulb showing decaying center due to basal rot.

Basal rot of the bulb is more serious in the eastern and southern states than in cool areas such as the Pacific Northwest. Most of the bicolor varieties are particularly susceptible. Presence of the disease is indicated by yellow foliage caused by a chocolate-brown rotting of the bulbs. Infected plants and bulbs should be promptly removed and discarded as soon as observed. Diseased bulbs cannot be cured. Expensive or large stocks may be disinfected for five minutes in a solution of phenyl mercuric acetate ($\frac{1}{3}$ oz. in 10 gallons of water). Treatment should be made within 3 days after digging and again just before planting. Emulsifiable heptachlor may be added (at a rate of $1\frac{1}{2}$ oz. active heptachlor in 10

Streaking of narcissus leaves as result of virus infection; healthy leaf on left.





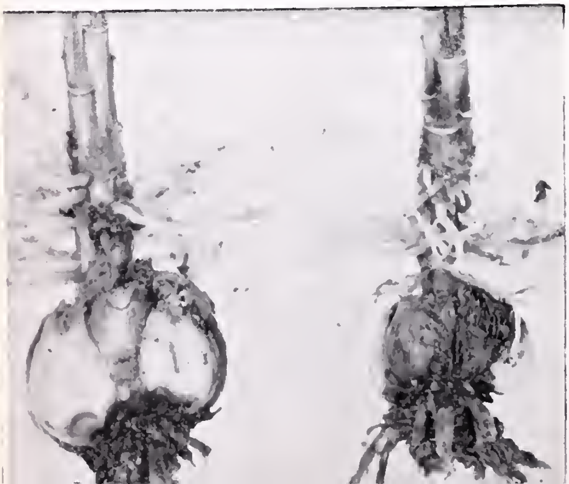
Westcott

Botrytis blight has killed the lower leaves on these lily stalks.

gallons of water) for protection against the greater bulb fly.

Mottling and streaking of the leaves with light green or white areas are often caused by viruses. The mottling, **mosaic,** appears early in the season, while the white streaking type appears later, during warm weather. Mosaic may also cause a light-colored streaking of the flowers. Since virus-infected plants cannot be cured of the disease, they should be removed.

Fusarium basal rot, most serious in warm climates, causes decay of lily bulbs.



Yellowing of plants may also be caused by waterlogged soil and by meadow nematode (eelworm) attack of the roots. Often in the latter case the roots are subsequently rotted by fungi. Locations of plantings should be changed if either cause is suspected.

Lilies

Every lily grower is probably familiar to some extent with the disease called **Botrytis blight** or **fire.** As with tulips, flowers as well as leaves are spotted and rotted. Leaf spots are brown and have a darker margin. Since the fungus does best under cool moist conditions, it is most severe in such areas as the Pacific Northwest, but it may appear wherever lilies are grown. Varieties vary in resistance, *Lilium candidum* being quite susceptible. Since the fungus overwinters in dead leaves and stems, these should be removed at the end of every growing season. Similarly, remove the winter rosette leaves of *L. candidum* types. Plant in a well-aerated location. Begin spraying when the disease appears, and continue at 10- to 14-day intervals during wet or foggy weather. Copper fungicides are preferable for this purpose, particularly home-made bordeaux mixture (8-8-100).

Yellowing or wilting may be caused by a fungus that attacks the roots and basal part of the bulb, resulting in a chocolate-brown rot. The disease is called **Fusarium basal rot.** It is most serious in warm climates and on certain species such as *L. testaceum* and *L. candidum.* All infected bulbs and plants should be discarded and no attempt should be made to propagate from them. Scales from healthy plants should be dusted with thiram or chloranil as a precaution. If the disease is found when digging, discard all diseased bulbs and move healthy ones to a new and well-drained location. Avoid the use of high-nitrogen fertilizers, especially the organic types.

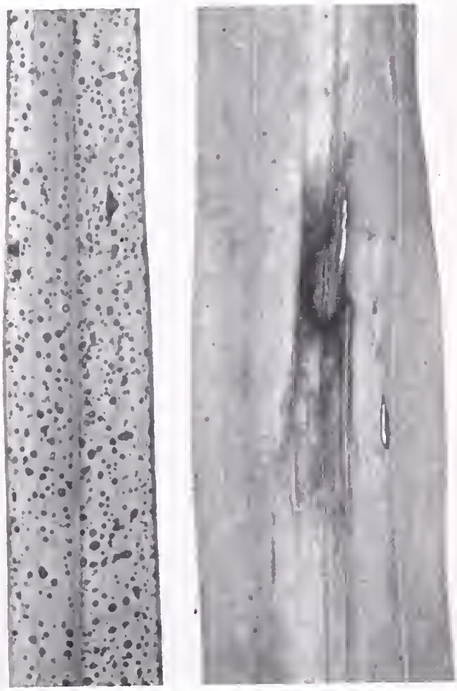
A mottling of dark and light green

areas usually indicates that the lily is affected with **mosaic**, caused by one or more viruses which are transmitted by aphids. Some mosaic infected plants may not show any symptoms, while others may be mottled, occasionally stunted, distorted, and even killed. Since the disease is seldom fatal, cannot always be detected by symptoms alone, and is very widespread, many growers have adopted the philosophy of "living with lily mosaic." Under this philosophy the very susceptible types are avoided. These include *Lilium formosanum* and *L. philippinense*. In addition, since the lily viruses can attack tulips, the two types of plants should be separated. (See PLANTS & GARDENS, Summer, 1949, page 98.)

Gladiolus

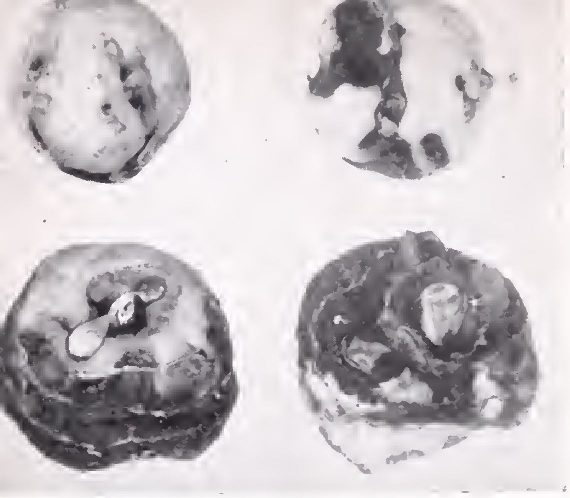
Gladioli are subject to several diseases. **Botrytis blight** or **fire** is one that is often encountered in home gardens, especially under cool, moist conditions. The fungus causes brown spots on the leaves and a spotting and decay of the flowers. It may also rot the bases of stems, which results in the leaves turning yellow. Varieties differ in resistance, but none is immune. The choice of a location with good air drainage and the prevention of weed growth will do much to prevent infection. Since the fungus is often found on old spikes, these should be removed and destroyed. Under cool, moist conditions it is necessary to spray or dust once or twice weekly. Ferbam, zineb, and maneb have been recommended for this purpose. The last two materials will also control certain other leaf spots.

Stunting and yellowing of gladiolus plants are often caused by rotting of the corms and roots. Three types of rots are


Author photos

Botrytis blight on gladiolus leaves showing variation in size of spots.

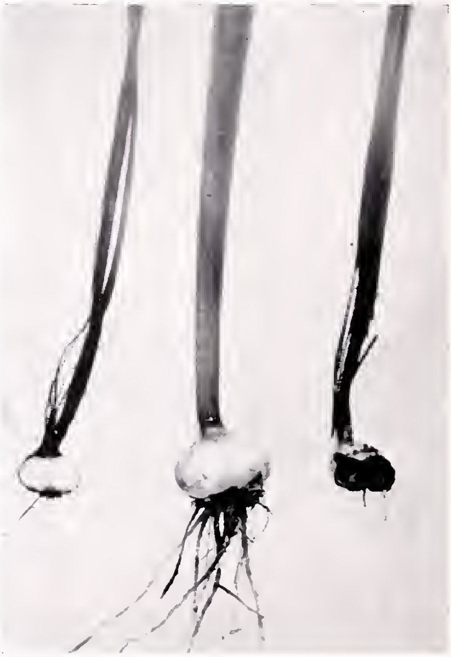
Spotting and decay of gladiolus flowers from Botrytis blight is similar to that on tulips.



Author photos

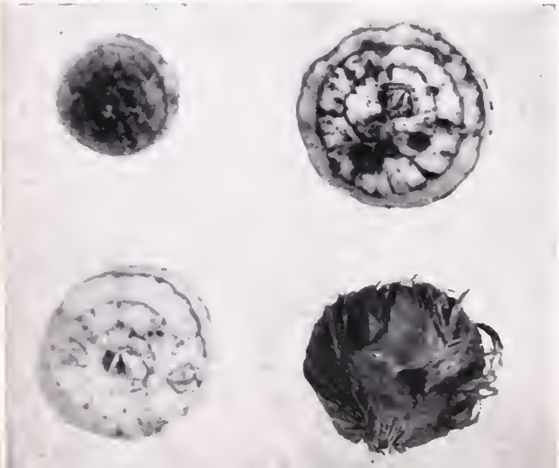
Botrytis rot commonly attacks gladiolus corms.

widespread: **Botrytis rot** and **Sclerotinia dry rot** are most common in cool wet areas and **Fusarium rot** in warm regions. Varieties differ in susceptibility. Home gardeners need not worry about the differences between the types since the control is in general similar. Gladioli should not be replanted in the same location more often than once every 5 years, since the corm rot fungi often survive at least that long in the soil. A well-drained location should be chosen since waterlogging weakens the plant and increases the chance of rotting. High-nitrogen fertilizers, particularly organic ones, should be avoided since they increase the susceptibility of the plants. Corms should be purchased from reputable dealers in order to insure disease-free stock. As an added safeguard, they may be dipped in a fungicide prior to planting. We prefer thiram (1 lb. in 9 gallons of water for 5 minutes) for cool areas such as western Washington, and New Improved Ceresan (3 oz. in 10 gallons of water for 30 seconds) in warmer areas. All plants that become diseased should be removed as soon as detected. Digging should be done as soon as practicable in the fall in order to get ahead of the cool wet weather that increases the chance of loss from dry and Botrytis rots. After digging, the corms should be cured immediately at a temperature of 80° to 90°F. and moderate relative humidity until the mother and daughter corms can be easily separated and cleaned. After cleaning, they should be returned to warm storage for 2 to 4 days in order to "harden up" and then put in a cool (40°-50°F.) dry place for winter storage. They should be stored in thin layers. All diseased corms should be discarded.



Shredding of gladiolus stems as result of dry rot; healthy plant in center.

Symptoms of dry rot of gladiolus corms.



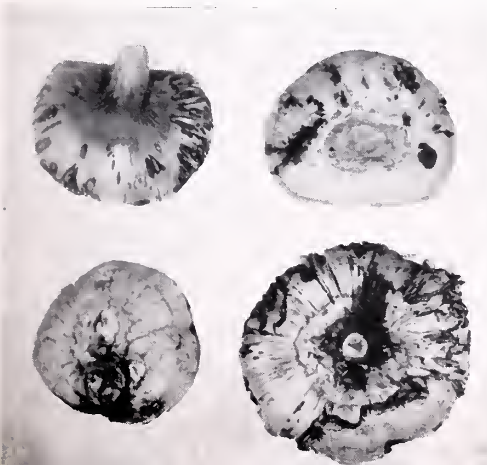
Scab is a bacterial disease that appears as sunken, more or less circular, brown varnished spots on the corm and as corroded or shredded areas on the bases of stems. The disease is common and occasionally serious. However, usually it does not hamper growth, but does cause an unsightly appearance that reduces sales appeal. The most promising control that has yet been developed is the addition to the fungicidal dip of aldrin or heptachlor at a rate of 3 oz. of the 20% strength to 10 gallons of water. These materials apparently protect corms from attack by wireworms and this in turn reduces the opportunity for infection by the scab bacteria.

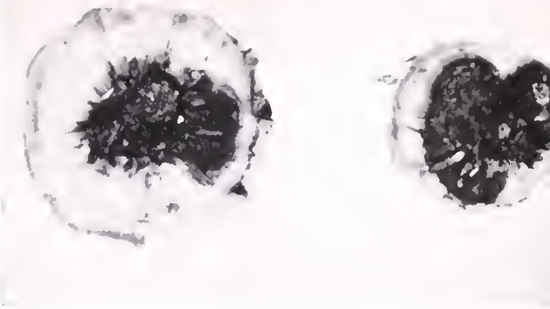
Gladioli carry several **viruses**, some of which affect the plants. The home gardener should remove plants with greenish-colored, misshapen flowers and those with white streaks in both the leaves and flowers. The other viruses do little harm to gladioli.

Iris

Both rhizomatous and bulbous iris are often affected by a **Heterosporium leaf spot.** The spots are brown in color with reddish-brown margins and are sometimes covered with a black mass of the causal fungus. If the spots are numerous, the leaves may turn yellow and die. This widespread disease may be prevented by three measures: (1) removal and destruction of all old leaves and stems at the end of the growing season; (2) changing locations every 2 or 3 years; and (3) spraying plants every 2 weeks with a copper fungicide or with zineb.

Gladiolus scab. The characteristic spots are quite different from the spotting and shredding due to dry rot, shown on opposite page.

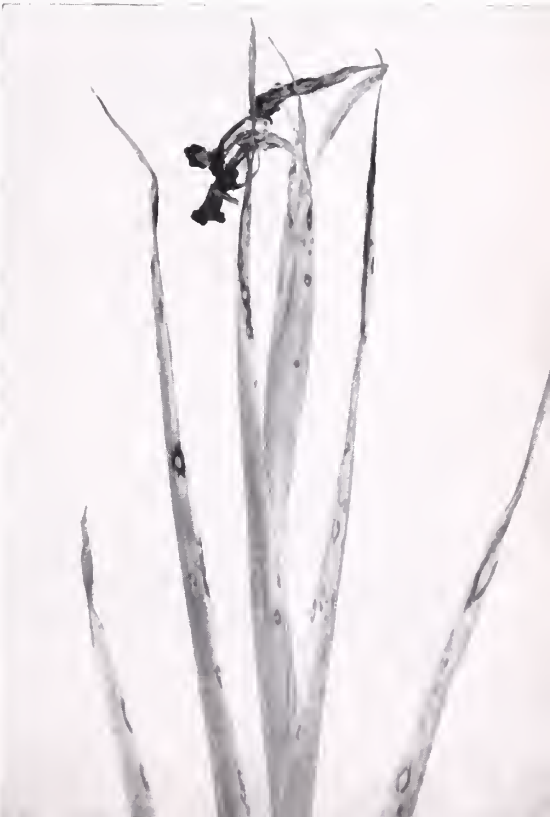


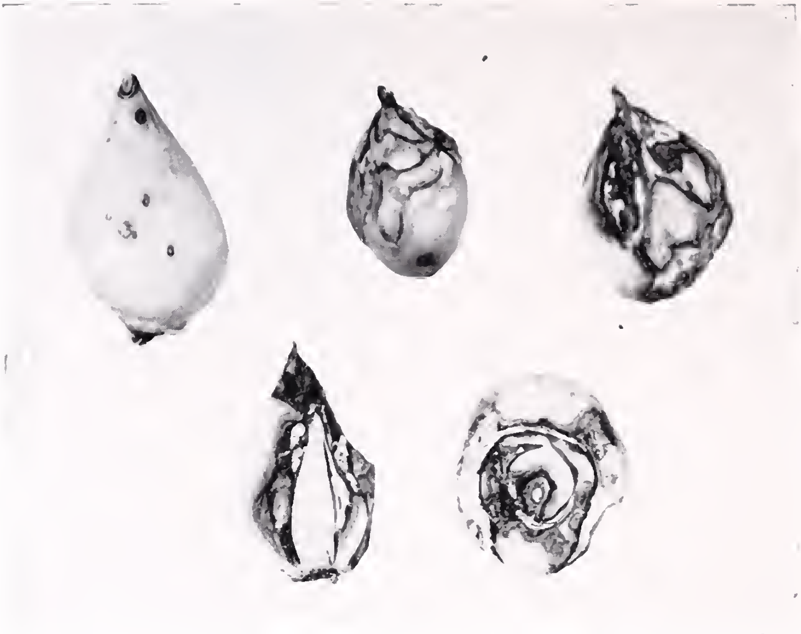


Fusarium basal rot of gladiolus corms. Compare spread of decay from base with irregular rotting caused by Botrytis rot.

Both types of iris may be affected by **crown rot**, caused by *Sclerotium rolfsii*, a fungus which rots the bulb, rhizome, and stem. The fungus produces small brown, seedlike bodies on or close to the plant which aid in diagnosing the disease. This fungus is difficult to control because it attacks many different types of plants and can overwinter on dead debris. An area where the disease has appeared should be put into lawn if at all possible, and a new location should be used for

Heterosporium leaf spot is a widespread disease of bulbous and rhizomatous iris.





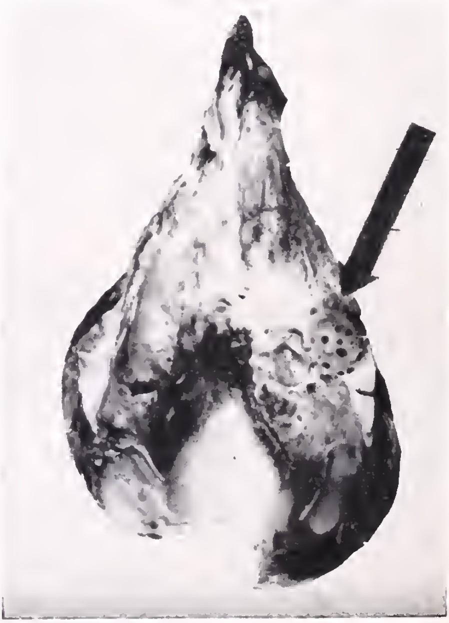
Author photos

Crown rot, shown here on bulbous iris, also attacks rhizomatous iris.

iris. Such a location should be well drained and the plants should not be crowded. Diseased plants together with the surrounding soil must be removed. We have found a double-barrelled treatment that works well commercially with affected bulbous iris stocks. Within 2 to 3 weeks after digging, the bulbs are treated for 3 hours in a warm (110°F.) formalin solution (0.5% commercial formaldehyde). Infested soil is cleaned up by mixing in a new material (PCNB or pentachloronitrobenzene) at a rate of 1 pound of the active material to 200 square feet of soil. We do not yet know whether this soil treatment affects rhizomatous iris or other ornamental plants.

On both types of iris, mottled leaves may be caused by winter injury, by unfavorable soil conditions, or by a virus disease called **mosaic.** The last is rather widespread. Therefore the most practical solution for home gardeners seems to be to "live with the disease," eliminating only the severely infected plants.

Small masses of the disease-producing fungus (arrow) are quiescent during winter season, whether on bulb or in the soil.



Rhizomatous iris may wilt, turn yellow, and die from a **bacterial soft rot.** The base of the stem and rhizome are soft and the odor is quite sour. The disease is common and appears most often in overcrowded, poorly aerated plantings. Infected plants should be destroyed and the remaining ones dug, dried, and replanted close to the surface in a new location having good air circulation. As an additional precaution, the apparently healthy rhizomes from a diseased stock may be soaked for 15 to 30 minutes in a solution of corrosive sublimate (1 tablet to 1 pint of water). (See page 60.)

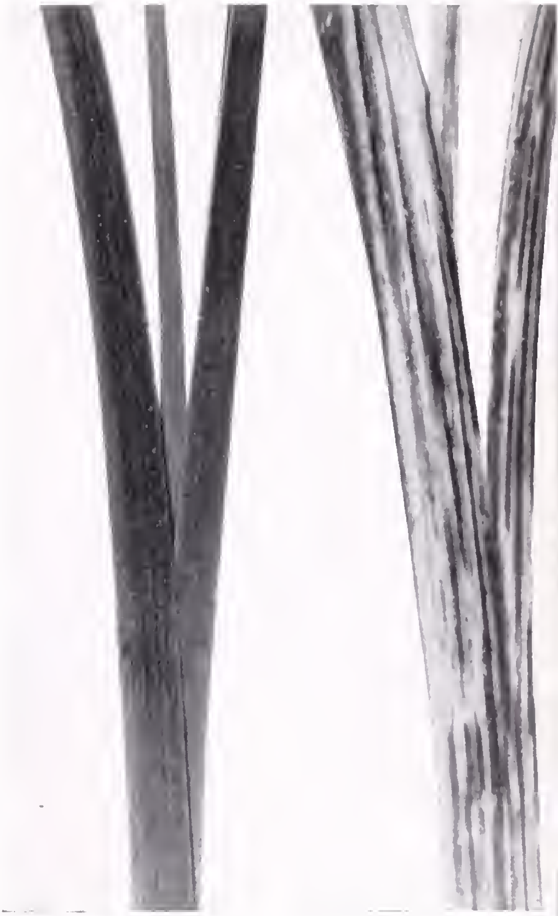
Several years ago we found that dipping iris bulbs in thiram increased their yield. This material has been used successfully by many commercial growers. During the past 3 years the new fungicide maneb has given even better results. In our tests in 1954, maneb (at 1 lb. in 8½ gallons of water) plus wettable aldrin (1⅓ lbs. of 25% type in 8½ gallons of water) more than doubled yields and practically eliminated blue mold, apparently by preventing wireworm injury.

Hyacinths

Hyacinths are seldom affected seriously by diseases. Only three need be discussed here. One that is common, but seldom serious, is a **mottling** or **mosaic,** caused by a virus. The elimination of severely affected plants is the most practical control by the home gardener.

Another disease, caused by a bacterium, results in the leaves turning yellow and drying. Affected parts of bulbs are yellow; from this symptom the condition gets its name of **"yellows."** It has seldom persisted for more than 2 years in imported diseased stocks planted in western Washington. Conditions here seem to be unfavorable for it, although they are very favorable for hyacinth culture. The home gardener should remove diseased plants and plant new bulbs in a new location.

Another disease, less often seen, is one caused by a **nematode** (eelworm) which produces yellow spots and later, yellowed distorted leaves. Infected bulb scales become swollen, and later dark and gummy. The most practical measure for the home gardener is the elimination of all affected plants, together with adjacent healthy ones, and planting a new area.



Author photo

Streaked leaves of iris infected with mosaic virus compared with healthy leaves (left).

Additional details on these and many other diseases may be found in Dr. W. C. Moore's bulletin on "Diseases of Bulbs" (Bulletin No. 117, Ministry of Agriculture and Fisheries, London, England, 1949).

It is a pleasure to express my appreciation for the suggestions of several colleagues, particularly Dr. F. P. McWhorter.

DISEASE PROBLEMS OF FOLIAGE PLANTS

What they are and how they may be overcome

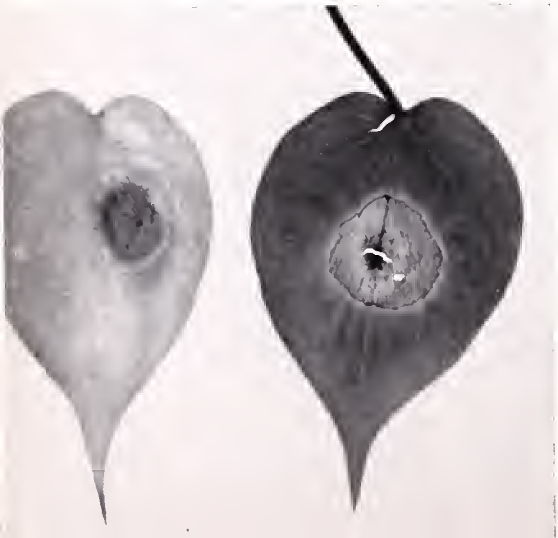
H. N. Miller

FOLIAGE plants, like others, are subject to various diseases. The disease may be a leaf spot or blotch which will not do any great harm to the plant. However, since such plants are grown for the beauty of their foliage, a few leaf spots may ruin their whole appearance. The disease may be a rotting of the stems or canes or it may be a decay of the roots, resulting in poor growth, stunting, and eventual death of the plant. When such disease problems do occur, appropriate measures must be taken to stop the development of the disease and to bring the plant back to health and ornamental attractiveness.

Fortunately, disease problems on plants growing in the home are not numerous. This is largely due to the fact that the plants are grown in a dry atmosphere, and usually, if the plants were healthy when brought into the house, away from sources of infection. Several of the disease problems discussed here may occur only rarely if at all in the home; however, they are potential problems and need to be recognized. One should use great care when buying plants to avoid those that may have some disease. Unfortunately not all apparently healthy plants sold to the home owner are disease-free. Organisms which cause disease may be present on healthy plants, in the soil, or on the containers in which the plants are growing. If conditions of temperature and humidity are favorable, a disease may develop later.

Leaf spot of *Philodendron oxycardium*; the round, tan-colored blotches are characteristic of the disease.

Photos courtesy Fla. Agric. Expt. Stations

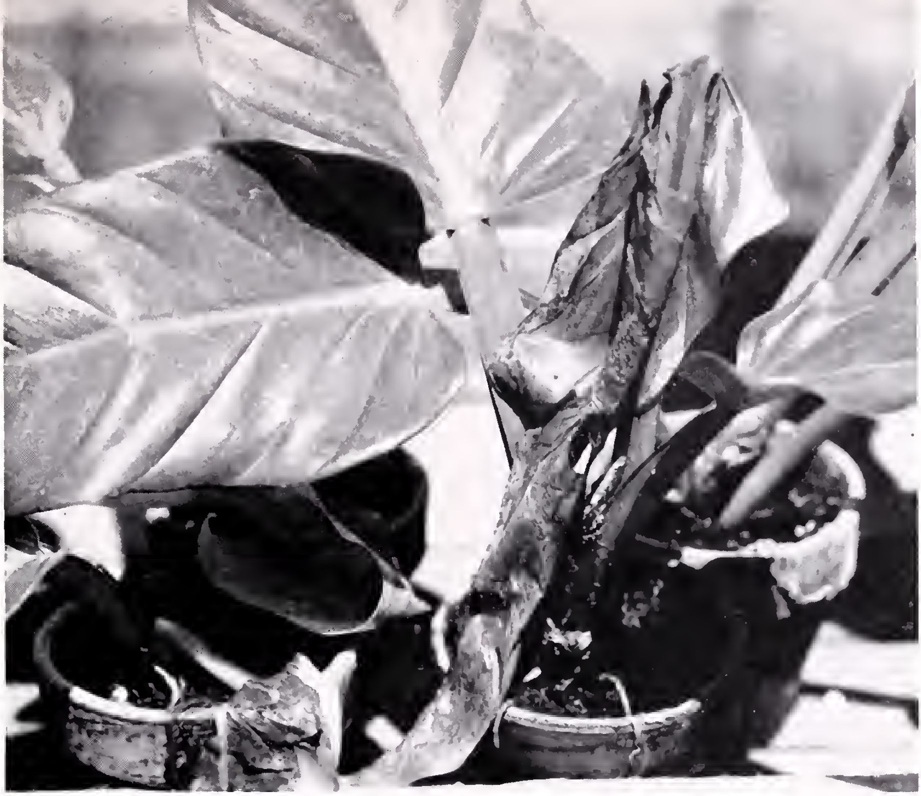


Three Categories of Disease

In general, diseases of foliage plants may be divided into three categories. There are diseases which attack the foliage, those that attack the stems or canes, and those that attack the root systems. It is not possible to cover here all of the known disease problems of this group of plants, but some of the more severe and most striking in the different categories will be discussed.

Foliage Diseases

Leaf spot of *Philodendron oxycardium* (cause:—*Phytophthora* spp.). More or less circular, tan or straw-colored blotches are produced on the leaves by this fungus. During development the spots are surrounded by a water-soaked margin, and may continue to enlarge in size until a



Bacterial leaf spot of *Philodendron;* collapsed leaves and stalk in center of picture are typical.

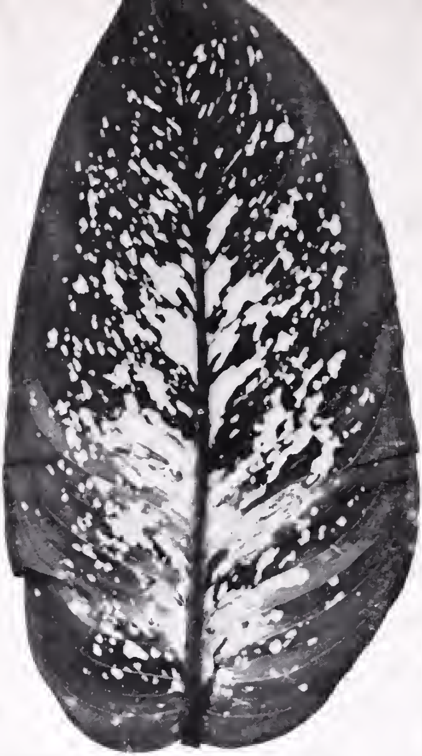
large area of the leaf is involved if conditions of high humidity and wet soil prevail. Upon drying, the water-soaked margin disappears and a definite reddish-brown margin develops. Usually no further development of the lesion occurs. The leaves may turn yellow and drop from the plant.

All diseased leaves should be removed from the plants. Use care in watering to avoid wetting the foliage. Humidity should not be kept too high.

Bacterial leaf rot of leaves and leaf stalks of various philodendrons is caused by an unidentified bacterium. The disease first appears as small, irregular, very water-soaked areas on the leaf blade. The water-soaking is first noticed on the lower surface of the leaf. During periods of high humidity and high temperatures development of the disease is rapid. Large areas of the leaf, or the entire leaf, are affected. Large water-filled blisters occur, followed by collapse of the leaf into a slimy mush. Leaf stalks may also become infected, resulting in their rapid and complete collapse.

Remove and destroy infected leaves as soon as noted. Badly infected plants should be destroyed. Containers in which these plants were grown should be well scrubbed and allowed to dry thoroughly before being reused. Soil in which the diseased plants were growing should not be used again unless completely sterilized. Spraying the plants with the antibiotic Agri-mycin has given effective control of this disease in commercial plantings.

Bacterial leaf spot of *Dieffenbachia* (cause:—*Phytomonas dieffenbachiae*). The leaf spots are at first tiny, translucent specks but soon enlarge to as much as a half inch in diameter. They are more or less circular in outline and yellow to orange-yellow in color. The central area of the spot may be a dull watery green.



Photos courtesy Fla. Agric. Expt. Stations

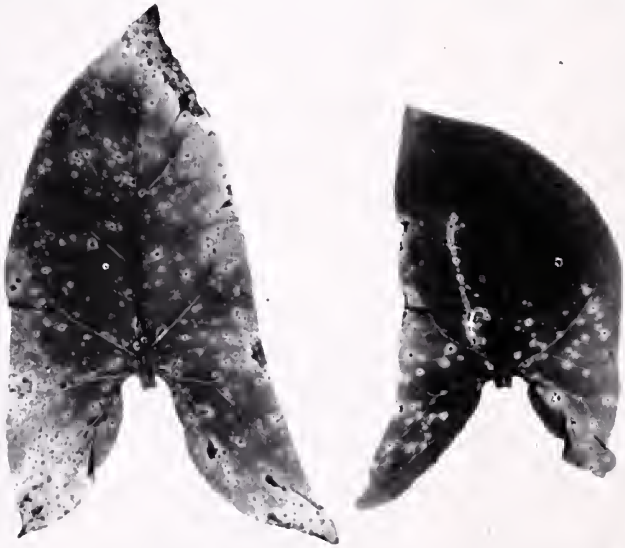
Spots due to bacterial leaf spot of *Dieffenbachia* (lower half) should not be confused with normal variegation of leaf.

During dry weather the lesions remain as small, dry, red-brown specks on the leaf. If conditions are favorable the lesions may coalesce to form rather large areas. Such areas become yellow, wilted, and dry, and eventually the entire leaf turns yellow and dies.

Separate diseased plants from healthy ones. Destroy infected leaves. Lower the temperature if possible and avoid syringing the plants.

The symptoms of **leaf spot** of *Nephthytis* and *Syngonium* (cause:—*Cephalosporium cinnamomeum*), are small, circular to irregular, dead leaf spots, reddish-brown surrounded by pale yellow borders. As the spots enlarge, the centers become grayish in color and papery in texture. If infection is severe, the leaves turn yellow and die. Reddish-brown elongated lesions may occur on the petioles.

Satisfactory control may be obtained by spraying the plants with a good fungicide, e.g., maneb, 1 ounce to 4 gallons of water, plus enough Dreft or other detergent to make a slightly soapy solution. Picking off infected leaves and maintaining a low temperature and low humidity will help keep the disease under control.

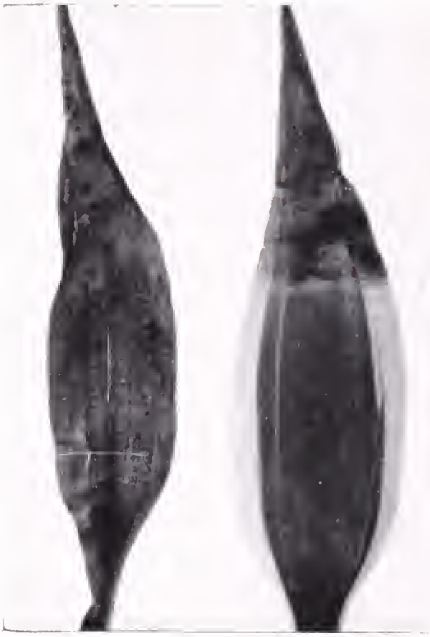


Typical symptoms of leaf spot of *Nephthytis.*

Tip blight of *Dracaena sanderiana* (cause:—*Phyllosticta* sp.) starts on the lower leaves, with center leaves dead only at the tips. While infection usually starts at the leaf tip, it may spread over much of the leaf from the tip toward the base. Diseased areas become sunken and straw-colored. As the tissue dies, small, pin-point, black specks (fruiting structures of the fungus) may be seen scattered over the surface of the lesion. If the disease continues to develop, all the leaves on the plant may be dead excepting a few green leaves at the top of the stem.

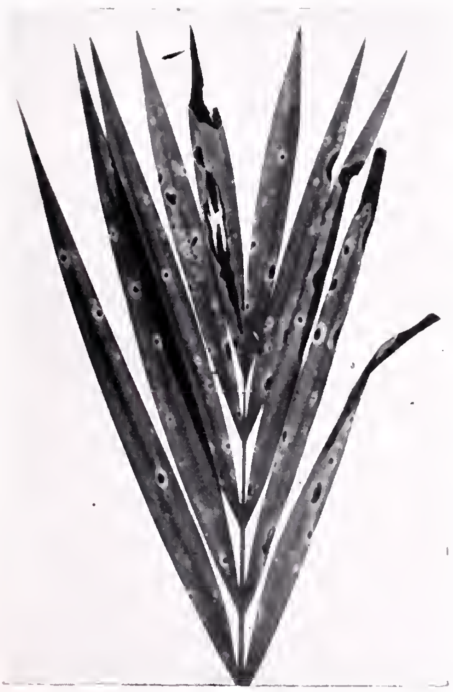
Remove infected leaves as soon as noted. Spray plants with a copper fungicide, e.g., Copper A (tetra copper calcium oxychloride) 1 ounce to 1½ gallons of water.

False smut or leaf scab of palm (cause:—*Graphiola phoenicis*) causes a yellow spotting of the leaves with the formation of numerous small black scabs or warts on the spots. These hard, dark bodies are the fruiting structures of the fungus. Badly infected leaves soon die.



Tip blight of *Dracaena* begins at the leaf tip (right) but may spread over entire leaf (left).

Leaf spot of palm may be troublesome if light is insufficient.

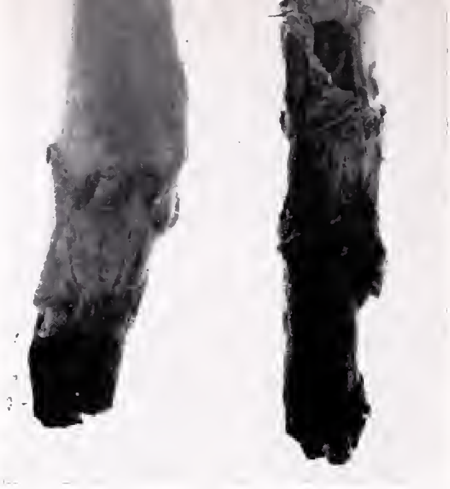


Cut out and destroy infected leaves and spray with a copper fungicide. Avoid syringing the plants.

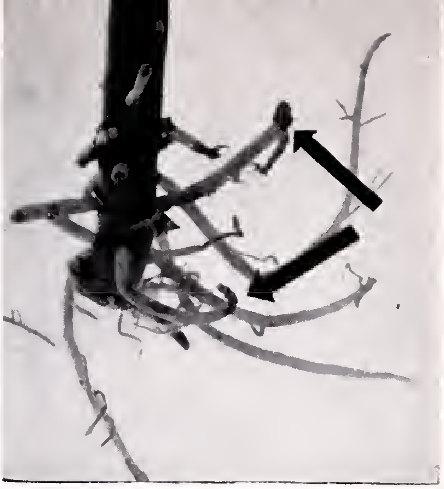
Leaf spot of palm (cause:—*Exosporium palmivorum*) is most serious where insufficient light is provided. The spots are small, round, regular in outline, yellow to reddish, and transparent. They may coalesce to form large irregular brown blotches. Death of the leaves may result.

Control is the same as for the false smut disease.

Symptoms of **leaf spot** of *Pilea* (cause:—*Rhizoctonia* spp.) appear as definite, more or less circular spots on the leaves. The spots are distinctly zoned, slightly raised, and corky in texture. The color of the spots is gray to tan, with the zonations showing as lighter gray rings. Several spots may grow together to form large blotches involving half or more of the leaf surface. Older infected leaves turn yellow and drop from the plant.



Courtesy Fla. Agric. Expt. Stations
Stem rot of *Dieffenbachia* is apparent at soil level and may extend above and below.



Courtesy W. B. Tisdale
Root rot, one of the few ailments to bother the sturdy Chinese evergreen (*Aglaonema*).

Avoid excessive humidities and syringing of the foliage. Pick off diseased leaves. Spray the plants with a good fungicide (e.g., maneb).

Stem Rotting Diseases

The first visible symptoms of **stem rot** of *Dieffenbachia* (cause:—*Phytophthora palmivora*) are small, irregular, water-soaked lesions on the stem at the ground line. Usually the lesions increase very rapidly and may extend an inch or more above and below the soil level. As infection spreads internally, the invaded stem tissues become soft and watery. The leaves of young plants may turn yellow and wilt. In older plants invaded tissues collapse, forming a brown cavity, which, as it continues to enlarge, weakens the main stem and soon causes breaking and lodging. The disease is favored by relatively high humidity, high temperatures, and poor soil drainage.

Plants should be propagated from disease-free canes or tip cuttings in sterilized soil mixtures. Dusting the cuttings with ferbam before rooting is helpful. Well-drained soil and careful watering of the plants will contribute toward disease-free plants.

General stem rotting diseases of foliage plants (cause:—species of the fungi, *Rhizoctonia*, *Pythium*, *Phytophthora*) usually appear as a blackening and rotting of the plant stems at the ground line. The rotted area may be soft and mushy or dry and spongy. The affected tissue may become markedly constricted. Although infection almost always occurs at the soil line, the entire root system may eventually be involved.

Tip cuttings can be taken from infected plants for propagation provided they are cut well above the infected area. The rest of the plants should be discarded. Use clean containers and new soil or soil that has been sterilized for propagation. Avoid over-wet soil and excessively high humidities.

Root Rots

First symptom of **root rot** of Chinese evergreen (cause: — *Pythium splendens*) on the above-ground parts of the plant is a stunting and yellowing of the leaves. The lower leaves may turn brown and die. Early symptoms of the disease on the roots are evident as light brown, water-soaked lesions of various lengths. In later stages, the diseased tissue turns brown and disintegrates. When the plants are pulled, most of the diseased roots remain in the soil. In the final stages all the roots have rotted and all the leaves up to the bud are dead. The basal ends of the canes may show a dry spongy rot.

Destroy diseased plants, or take tip cuttings well above the ground, dip them in ferbam and root in sterilized soil. Avoid wet, poorly-drained soil.

INSECT PESTS AND DISEASES OF IRIS AND DAYLILY

How to recognize them and what to do about them

Irene Van de Water

THE insects and diseases treated in this article are those which can be found in New York State on tall, intermediate, and dwarf bearded iris, and on daylily.

Chief Insect Pests of Iris

The worst pest of iris is the **iris borer** (*Macronoctua onusta*). It overwinters in the egg stage. A female moth lays clusters of eggs on dead iris leaves or other nearby debris in the fall. In April these eggs hatch and the minute caterpillars crawl up the iris leaves. This is the stage when control measures should be most diligently applied. Close daily observation of the inner edges of the fans should be made to see if the characteristic ragged chewing of the leaf margins is present. If the small borers are not killed with insecticides at this stage, they will bury themselves in the folds of the leaves and eat their way down to the rhizome. Here the caterpillar grows to an astonishing 2-inch pink worm, which if it were not repulsive to the iris grower because of the damage it does, might really be considered quite ornamental. Its dusty-pink translucent color is unusual and arresting, if viewed dispassionately. Because borers are such voracious feeders, generally only one is found in a rhizome. When the caterpillar has reached maturity it leaves the now empty shell of a rhizome and goes a few inches below the plant and there turns into a mahogany-brown pupa, about 1 inch long. It remains in the pupal stage for about a month, then wriggles its way upward to the surface where it splits open to release a moth. Since this moth is a night-flier, it is seldom seen. It may be found at twilight skulking, not flying, at the base of an iris plant. It is a tawny, nondescript moth with a stout body about 1 inch long and a wing spread of about 2 inches.

To control this pest, early in April dust all iris foliage as well as the soil

Large, pinkish larvae of iris borer, one of the worst pests of iris.

Westcott

around the plants, and even the nearby vegetation within a radius of 20 feet, with a 5% DDT dust. Use an extra heavy hand with the dust in the shadier parts of the garden, since that is where the insects were probably most abundant the previous year and that is where the eggs were laid. This dust should be applied 2 or 3 times at 10-day intervals. This may sound drastic, but drastic measures are often needed in large plantings. A commercial product known as Protexall has been found very satisfactory, as well it might be, judging from its formulation. It is a dust made up of DDT, rotenone, sulfur, and Fermate. Since it contains two insecticides and two fungicides it really ought to protect the iris from all its enemies.

Common stalk borer (*Papaipema nebris*). Very little has appeared in iris literature about this borer, and yet it stands second to the iris borer in destructiveness. In iris plantings surrounded by uncut weedy fields, this insect can be found in the flower stalks or in the rhizomes as often as is the iris borer. In appearance and behavior it is quite distinct from the latter. This caterpillar is not a one-toned dusty pink, but has alternating lines of white and chocolate-brown down the length of the body, with a median girdle of solid brown. Unlike the iris borer which feeds exclusively on iris, this insect has a wide range of plants for its diet. Any plant with a stem large enough to shelter it and soft enough to offer little resistance will do. Corn and ragweeds are its favorite foods. In behavior, these caterpillars differ in several respects from the iris borer. They are restless and agile and move from plant to plant frequently. They may start feeding on bluegrass when first hatched, then move to ragweed, then to iris in May or June when they suddenly discover that the flower stalks are ready and succulent. The borer climbs up the stalk and at any distance bores a hole and enters the center of the stalk, throwing out frass from the entrance hole, a sign quickly giving away the secret of its presence within the stalk. Its pupa is about the same size, shape, and color as that of the iris borer. The moth is the same size as the latter, but it has more definite patterns on its wings.

To protect iris from this pest keep all weeds and grasses around the garden cut. Dust the ground around the iris with DDT, to catch the restless caterpillars as they crawl from plant to plant. Dust stalks of iris during May and June. Stalks which are purposely left to mature seed pods are often attacked, so they should be kept dusted. Perhaps some of the newer and stronger insecticides such as parathion, malathion, or chlordane would be better insurance for these important seed-bearing stalks.

Aphids. The potato, bean, peach, corn, and tulip aphids have all been reported on iris. In rainy seasons and in the fall, when they migrate from other crops, they are more prevalent. It is obvious that the sucking of large numbers of aphids will deplete the food reserves of a plant, causing it to become yellowed and unthrifty in appearance. However, the chief grievance against aphids is that they are known to be virus carriers and may well be the carriers of some as yet unrecognized types of virus diseases to iris. Like the potato tuber, the iris rhizome is ideally formed to harbor many viruses.

Dust with parathion* if you really want to control these pests.

Lesser Insect Pests of Iris

Verbena moth. Iris hybridizers, who must harvest the seeds they purposely set, are sometimes troubled by the caterpillar of the verbena moth. This caterpillar, safe in the iris seed pod, feeds on the seeds until it is ready to pupate, emerging later as a small moth.

Dust seed pods with DDT, and get it on before the caterpillar arrives.

Like aphids, the **thrips** may be present but their damage not very apparent. Hybridizers often see them in the flowers, especially in the dwarf iris. Perhaps they are eating the pollen, and perchance may effect unwanted cross-pollination. They are definitely known to be carriers of virus diseases so they should be eliminated.

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* Don't fool with parathion unless you understand its danger and the necessary safety precautions.—Ed.

To control them dust with DDT, or spray with lindane or nicotine sulfate.

When **grasshoppers** are very abundant in the fall, they will nibble the edges of iris leaves, if other greenery is sparse. Chlordane is the correct answer for these pests.

Sowbugs have been known to infest coldframes where iris seedlings are grown, and to eat them off at the soil line. Place a mixture of 1 ounce Paris green and 9 ounces sugar, dry, in a tin in the frame at night and remove during the day.

A small, round, grayish **weevil** can often be found on one of the old, very fragrant blue iris varieties. It feeds on the flower buds, the petals, and the seed pods. Since it is not found on other varieties, perhaps it is an indicator of fragrance in iris.

Hand picking is the easiest and surest way to control weevils. The new dieldrin and methoxychlor are also good.

Principal Iris Diseases

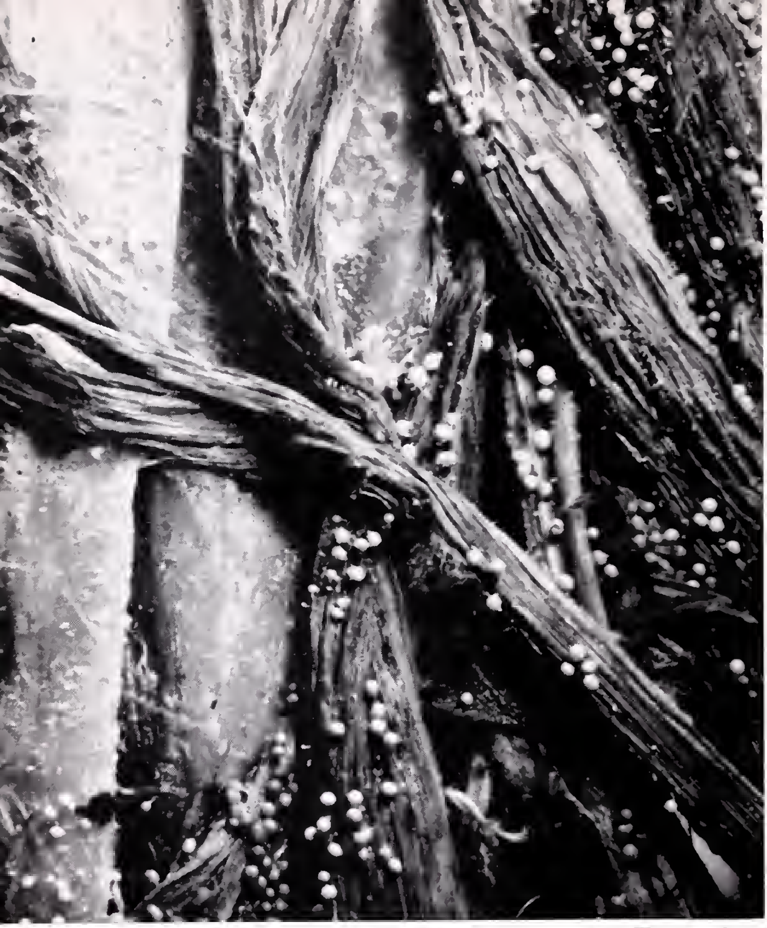
If a survey of iris diseases were made, it would show that **leaf spot** (*Didymellina macrospora*) is the most prevalent and annoying even though not the most serious one. The brownish spots, which in severe cases merge and cause the tip and upper half of the leaf to dry up, produce a most unsightly picture which distresses the gardener. It is most prevalent during rainy seasons and certain varieties of iris are much more susceptible than others. The fungus which is responsible can be spread during wet weather by wind and rain and by brushing the foliage in passing. If the soil is low in lime, the disease is more serious. Though it never kills plants outright, it does reduce the amount of bloom.

Buhle

Sowbugs, shown here slightly enlarged, are chiefly scavengers, but occasionally attack young seedlings.

Eliminate susceptible varieties (e.g., NARANJA). Cut off diseased tops and burn them. Fall clean-up is very important. In spring, dust with Fermate.

Rhizome soft rot (*Erwinia carotovora*), a bacterial disease, is the most offensive and destructive of the iris diseases. The organism has several strains which attack many vegetables. It is, therefore, sure to be found in soils of old gardens. Humid, rainy weather, poor drainage, dark shady areas of a garden, and animal manures are all associated with this disease. For years iris growers were cautioned not to use animal manures. Recently several experimenters have been using it liberally and "getting away with it," producing huge plants and flowers. However, animal manures are perfect media for the culture of fungi and bacteria. Some day when the temperature, the humidity, and the right organism are in ideal balance, these growers will not "get away with it." The iris borer is



Resting bodies (sclerotia) of sclerotic rot actually resemble mustard seed and aid in diagnosing the disease.

Westcott photos

said to be a carrier of this organism.[1] Perhaps the true explanation is that the borer as it continually makes fresh wounds prepares the iris for invasion by this ubiquitous bacterium. The first symptoms of the disease are browning of leaf tips; later the leaves fall flat on the ground. If one gives a slight tug to a fan of leaves, it will come right up with a small piece of the rhizome attached. At once the characteristic foul odor can be noticed. The rhizomes of the infected plant have become a yellowish, mushy, ill-smelling mass with only the outer shell of the rhizome intact.

Though the organism works fast when started it can also be quickly brought under control. Cut off, or scoop out with a spoon, the soft portions of the rhizome and dust the rest with gypsum (land plaster) or copper carbonate, or just expose the cleaned rhizomes to air and sunshine for a few days. A 1 to 1000 mercuric chloride solution can be used on the cut surface and on the soil around the plant to disinfect it. Burn all infected material. Plant choice varieties in new soil. To starve out the organism in the soil, rotate from crops with bulbous, fleshy roots to those that are fibrous-rooted.

The first indication of **mustard seed** or **sclerotic rot** (*Sclerotium rolfsii* or *delphinii*) is the prostrate leaves. They have rotted off at the soil line and there the tissues are green but water-soaked. Close examination of the soil around the plant reveals a fine, white, webby growth of fungus. Later these white strands concentrate into round, brownish bodies, about the size of mustard seed, which are called sclerotia. They are the resting bodies of the fungus and they enable it to endure adverse conditions for long periods. Control measures, therefore, involve the destruction of these sclerotia.

This fungus is not an easy one to control. Soil containing the sclerotia should be removed and destroyed. But how? Such soil may be thrown in the middle of a deep pond or in deep running water. Not having these near by, what can the gardener do? The infested soil can be put in a pile and on top of it all the inflammable trash which is to be burned. If several fires are set on top of this contaminated soil, in time it ought to be free of the sclerotia. Rhizomes which have been growing in and around the infested soil can be sterilized in a solution of Semesan. There are some careful growers who treat all their newly received rhizomes with Semesan, to be sure they will not bring any undesirable alien diseases to their new residence.

Botrytis rhizome rot (*Botryotinia convoluta*). Occasionally in early spring, rhizomes which were set out in the fall will be found dead, because of a fungus which works during cold weather on dormant iris. The inside of the rhizome has been converted into a gray, odorless, felt-like material; there are masses of black, bead-like bodies on the outside.

All of this diseased material must be destroyed and the soil sterilized. See control of sclerotic rot.

Less Important Iris Diseases

Mosaic (*Marmor iridis*) is the name of a disease caused by a virus, which is an ultramicroscopic particle seeming to have some of the attributes of living material and also of chemical proteins. Some virus strains are very easily transmitted by touch, others must spend some time in the body of an insect before the insect can transmit them to a plant. Iris mosaic is not easily transmitted. It is found very commonly on dwarf iris and those tall, bearded types which have Oncocyclus blood. WILLIAM MOHR, an example of the latter, is known to be very miffy and an uncertain bloomer. This is undoubtedly due to the presence of mosaic virus. In the trade catalogs, another WILLIAM MOHR is offered which is said to have bigger and better growth and flowering. This is probably from a clone which does not have mosaic. The disease is recognized in early spring by the general yellowish tone to all the leaves. Careful scrutiny of the leaves, especially if a shade is cast on them, shows areas of very light green and very dark green, due to the uneven distribution of chlorophyll. In bad cases the whole leaf may have yellowish-brown longitudinal stripes. Later, when the flower appears, it too shows mottling due to irregular distribution of pigments. The flower mottling is most pronounced in cold, rainy weather; the leaves seem to grow out of their symptoms as the season advances.

Leaf spot of iris (page 62) thrives in damp, shady places and in wet weather.

There is no known cure for mosaic. It is generally recommended that the diseased plant be destroyed. In the case of iris it would mean that many varieties would have to be discarded entirely. Aphids and thrips, known to be virus carriers, should be controlled to stop spread of the disease.

The causative agent of **scorch** or **red fire** is unknown. Sporadic cases have appeared in several gardens in New York. Perhaps they have come in from the southwestern states where it is more common. The disease has been reported on the tall and dwarf bearded iris only. The symptoms show up in spring before the flower stalks appear. The leaves start turning a bright reddish-brown at the tips. In a few days, the whole fan will have become involved, looking as if it had been scorched and withered. On examination, it will be found that most of the roots have died and that they, too, have a reddish discoloration where they come out of the reddish rhizome. The disease does not spread to neighboring plants nor has it been experimentally induced. The plants generally die, but some have been saved by dipping rhizomes in a solution of potassium permanganate for a few minutes and drying in a shady spot for a week or two. Disinfect soil with a copper-ether solution, commercially known as Lawn-a-gen.

Bacterial leaf spot (*Bacterium tardicrescens*), which appears in late June, starts as small pale areas scattered over the leaf, sometimes more numerous along the edges. These areas gradually expand longitudinally, become water-soaked, irregular spots and finally dry into brown dead areas. The disease thrives in rainy seasons, and in damp shady places in the garden.

Good sanitation is most important in controlling bacterial leaf spot. Remove dead leaves in fall and burn them.

Pineappling, a new disease whose causative agent is unknown, has been reported from southern California. In case it is sent to New York State its symptoms should be known. Affected plants throw up abortive flower stalks with no new leaf or root growth. If any cases show up in this state the writer would appreciate notice.

Daylily

The daylily (*Hemerocallis*), which came from China originally, seems to have left its insects and diseases there. It does have a few pests here, but they are very minor ones. For plantings around summer homes, parks, and highways daylilies are superior material since they require so little maintenance. One New York grower who has been raising seedlings for many years says he has never yet used pesticides, but thinks he sees the day coming when he should.

Insects on Daylilies

The most often reported insect on daylilies is the **thrips.** It is a sucking insect which does its worst damage to the flower. When thrips are numerous and feed upon the buds the resulting flowers are somewhat deformed and the color is spotted and disarranged. The insects may also feed upon the foliage, causing silvery streaks due to rasping of the epidermis.

To control thrips use DDT or lindane several times during the blooming season.

Tarnished plant bug feeds on many garden plants and now it has found the daylily to its liking. Like the thrips, it sucks the juices of the buds, causing petals to become deformed and spotted. Control is the same as for thrips.

Beetles. Some growers report little holes in the flower buds and consequent perforated petals. Spotted cucumber beetles and imported long-horned weevils both work on flowers and may be responsible for this damage. Chlordane will control them.

Grasshoppers have been found eating the hybridizer's paper tags which mark crosses made on flowers. Chlordane will take care of them as well as beetles.

Leaf Spot

Some varieties of daylilies are more susceptible than others to a fungus leaf spot (*Heterosporium gracile*), similar to the iris leaf spot, which shows up late in the season. Fermate would no doubt give effective control.

LAWN PESTS

How to recognize and combat those most likely to cause trouble

Frank L. Howard and Malcolm C. Shurtleff

THE standards for fine healthy lawns have risen rapidly in recent years. This has been made possible by improvements in maintenance practices, site-adapted compatible grass mixtures, introduction of new grass strains, and chemical weed control agents. A major factor has been the increased use of insect and disease control measures. Since initiating research on turf in 1890, the Rhode Island Agricultural Experiment Station has continued to provide information on how to improve home lawns. Its "Maintenance Tips" are available upon request.

Lawns can be attacked by over a hundred known fungus and bug pests. The prevalence of different forms from year to year and during a given season is closely dependent upon prevailing temperatures, rainfall and sustained humidity, soil conditions, grass variety and vigor, natural parasites, etc. Fortunately only a few pests become sufficiently abundant in any one area to warrant special control measures. While not every home lawn owner can be expected to become a "plant doctor," the characteristics of a few of the more injurious pests are given here to assist in determining the proper choice of an effective control measure. A magnifying lens (5x or 10x) will greatly assist in identification, particularly of diseases. If the problem is unusual, seek help from your garden supply store, nurseryman, county agricultural agent, or agricultural experiment station specialist. The damage commonly encountered is caused by the insects, diseases, and nematodes described below.

Insects

White grubs include Japanese beetle, Asiatic garden beetle, May and June beetles, Oriental beetle, masked and rose chafers. Grubs feed on the roots of grasses. If present in numbers, the turf is loose and dead or stunted in brown scorched patches that may be lifted or rolled up easily to expose the feeding grubs below. The thick, sluggish, white-bodied, U-shaped grubs with yellowish-brown heads and legs are from ¾ to 1½ inches long when full grown. Skunks, moles, and birds dig up the turf searching for them as food.

Insecticidal dusts or sprays may be applied at any time of the year, except when the ground is frozen; April and early May are best. A single grub-proofing treatment should last for 3 to 5 years or more. **Caution:** All grub-proofing chemicals should be washed into the soil immediately after application to prevent possible poisoning of birds and pets. Chlordane is the insecticide generally preferred, since it is effective against most species of grubs and other soil insects. For each 1000 square feet apply either 5 lb. of 5% dust, 10 lb. of 2.5% granulated, or 8 oz. of 50% wettable powder. The two former types may be mixed with fertilizer (not lime) and

White grubs, larvae of several kinds of beetles, feed on roots of grasses and other plants. When infestation is heavy, dying turf can be rolled back like a carpet.

Buhle

applied with a spreader cart, while the powder is suspended in 10 gallons of water and sprayed on. Lead arsenate at 10 lb. per 1000 square feet is effective but more costly. Dieldrin at 5 oz. of a 25% wettable powder or 8 lb. of a 1% dust, where obtainable, has provided good protection. DDT applied as 20 oz. of 50% wettable powder in sprays, or 12 lb. of 5% dust, kills Japanese beetle grubs but not May or June beetles and chafers.

Ants. Various species construct either small hills or large spongy mounds in lawns.

Where ant hills are numerous, apply chlordane or dieldrin to the area at two-thirds the rate suggested for white grubs. Wash in immediately after treatment with at least 25 gallons of water per 1000 square feet. Spot treatment may be sufficient to eradicate a few scattered hills. DDT and lead arsenate are ineffective.

Chinch bug. Infested lawns in hot, dry weather may turn a light gray-brown color and by late summer irregular dead patches have formed. Look at the edges of the patches for numerous small, red and brownish-black, crawling bugs in the crowns of the grass plants.

A single application of chlordane, dieldrin, or DDT about July 1 usually suffices, but a second treatment about August 1 may be needed. About half the strength used for white grubs is suggested. Close cutting and a dressing of fertilizer will accelerate the recovery of infested areas after insecticide treatment.

Sod webworm. Infested lawns appear ragged and patchy from early spring to midsummer due to chewed leaves and stems. Small, short (¼ to ¾ inch), thick-bodied, often spotted caterpillars live in silk-lined web tunnels at the grass base. Tunnels are covered with dirt and bits of grass. In searching for the webworms birds peck holes in the turf.

When the injury is first noticed, apply chlordane or DDT at one-fourth the strength suggested for white grubs. Repeat treatment, if necessary.

Cutworms (Armyworms) are caterpillars up to 1½ inches long when full grown. Brown, greenish, or nearly black and often striped lengthwise, they may appear any time from spring until late summer. They chew off the leaves in irregular spots in lawns.

Use the same insecticides as for sod webworm, preferably applied in the late afternoon or early evening.

Nematodes

Numerous parasitic species of microscopic eelworms (nematodes) feed externally and internally on grass roots. Irregular patches of apparently healthy leaves interspersed with those dying back from the tips give a yellow cast to lawns. The full extent of nematode injury to lawns in the Northeast has not been determined. Nematode damage is often mistaken for drought injury, fertilizer burn, soil nutrient deficiencies, disease, insect and other types of damage. Plant parasitic nematodes can be identified only by taking plugs of suspected turf and subjecting them to a microscopic examination of the soil in the laboratory.

For the present, keep grass growing as vigorously as possible with recommended cultural practices. Chemical control measures are being studied at the Rhode Island Station.

Moles

These small, furred, nearly blind animals feed almost entirely on earthworms, various kinds of grubs and other soil-inhabiting insects. Ridges in the sod indicate runways burrowed about an inch below the soil surface. Injury is more common in shaded, moist locations.

Lawns treated to control insects are less likely to be invaded by moles searching for food. Harpoon-type or choker-type traps are commonly used. Select freshly-made runways and use the traps following the manufacturer's instructions.

Diseases

Bluegrass "going-out" (Leaf spot, Foot rot). This serious fungus disease of bluegrasses (*Poa* spp.) such as Kentucky, delta, Canada, rough, and annual, develops from March through May and again in the fall during cool, wet weather. The plants appear to thin out in rather large areas as attacked leaves shrivel and stems, crowns, rhizomes, and roots turn brown and rot. Exposed soil is then rapidly invaded by weeds, especially crabgrass when in full sunlight.

Recent research has shown phenyl mercury compounds to be most effective for control. Two to four applications at 2-week intervals, starting the last week in March, should be sufficient. Use 1.5 oz. of 10% active material or equivalent in 5 to 10 gallons of water sprayed evenly over 1000 square feet of lawn. Merion bluegrass is highly tolerant to this disease; here it is restricted to a purple spotting of the leaves, never the destructive foot rot. **Caution**: Merion bluegrass is sensitive to injury by phenyl mercury compounds.

Curvularia "fading-out" (Black mold) develops on bentgrasses (*Agrostis* spp.) particularly velvet, fescues (*Festuca* spp.) and annual bluegrass (*Poa annua*), most commonly when growing in direct sun on exposed slopes, along paths, driveways, etc. Although most severe injury occurs during the hot summer months, the disease may occur from mid-May through October. Diseased lawns exhibit an indefinite serpentine, yellow-green, dappled pattern, which at times is confused with chemical injury, drought, soil iron deficiency, or dollar spot. If a magnifying lens is used, a black mold may be seen growing on dying and dead grass blades.

Mercury-containing fungicides, particularly phenyl mercury compounds, have proved most effective. Use ¾ to 1 oz. of 10% active ingredient or equivalent in 10 gallons of water per 1000 square feet. Several applications at about 10-day intervals may be required. During hot weather apply the chemical in the early evening, and do not apply when temperatures above 80°F. are expected during the following 12 hours, or injury may result.

Brown patch. During periods of high air temperatures and humidities, more or less circular patches of lawn up to several feet in diameter are damaged by the causal fungus. The patches will enlarge when the soil temperature is 60°F. or above and the grass blades are wet. Also, a "smoke-ring" of cobweb-like fungous threads forms as a band 1 to 3 inches wide among the grass blades at the advancing margin of the patch when the air temperatures are above 70°F. and the humidity is near or at saturation. The attacked grass first appears to be water-soaked, soon turns dark, and the leaves wilt. Later the diseased plants dry out and the patch becomes a light brown color; usually only the leaves are killed. Hence, after fertilizing and several mowings, the lawn may regain its normal healthy appearance. Although all grasses may be injured under favorable conditions for the fungus, the colonial bents are damaged most.

The disease can be minimized by the following preventive measures: (1) avoid the application of excessive amounts of quickly available, high-nitrogen fertilizer at one time, which will promote the growth of soft, lush, susceptible grass; (2) water lawns in the morning in time for the leaves to dry off before nightfall; (3) provide for better air circulation by the open pruning of surrounding, close-growing trees and shrubs; and (4) provide soil drainage for low-lying areas where water may stand. Mercury chlorides are generally more effective than thiram, but they may cause a temporary slight yellowing of the turf when applied during hot weather. Calocure is safer to use than Calo-clor. Thiram has not caused injury at temperatures normally encountered. Follow recommendations of the manufacturers for rates and timing of applications.

Dollar spot is active during cool wet weather from late spring to early fall, particularly on some strains of creeping bent. When active, during the early morning, a fine web-like white mold is suspended between the grass blades that make up the 1- to 2-inch spots. The killed grass plants soon become bleached or straw-colored and unless checked the spots may become so numerous they coalesce to form large, irregular sunken areas.

Cadmium-containing fungicides, when applied at monthly intervals from May through August, are excellent preventives. Or, to cure an attack, two applications by spraying 7 to 10 days apart will permit infected turf to recover quickly, otherwise the disease may continue to increase through the growing season. Dollar spot is often held sufficiently in check by regular application of the less specific mercury-containing fungicides. It is suggested that the Toronto strain of creeping bent be avoided because of susceptibility to this disease.

Pink patch (Red thread) is a pink-white mold which attacks and kills the grass leaves in distinct patches 1 to 8 inches in diameter. During moist weather pink gelatinous fungous strands or "threads" mat or bind the grass blades together. Upon drying, the "threads" shrink and become a bright coral-red color. The fescues and creeping and colonial bents in mixtures are attacked,

Author photo

White webs of snow mold may be seen on lawns as snow melts; killed patches of grass require time and care for recovery.

Fairy rings of mushrooms or puffballs in lawns may be accompanied by some destruction of grass within the ring, but damage is not apt to be serious.

Ramaley

but the disease is usually most prevalent on pure stands of velvet bent.

The application of fungicides for other diseases will generally prevent this one. However, one or two applications of a cadmium-containing fungicide applied according to the manufacturers' directions will quickly cure this trouble.

Snow mold (Winter scald). When the lawn is uncovered from melting snow, patches from a few inches to several feet in diameter of dense dirty-white, gray, or pink mold may be seen. The causal fungi thrive at low temperatures and on the weakened grass plants. Several months' time and fertilization are required to permit the grass in the killed patches to recover. Snow mold is most severe in low sites, shaded from the winter sun, where a deep snow covering is prone to persist. Leaving the lawn uncut in the fall where the leaves form a thick mat favors the disease. Although most lawn grasses may be injured, the creeping bents—especially SEASIDE—are most susceptible.

The application of a fungicide, such as mercury chloride, phenyl mercury, or thiram just before the first heavy rainfall is forecast in late fall or early winter is the best preventive. Dosages are suggested by the manufacturers.

Fairy ring (Mushrooms or Puffballs). Somewhat circular, narrow bands of greener, more vigorously growing grass up to many feet in diameter may be noticed in lawns. There may be a zone of dead or dying grass inside the band of stimulated growth. Rings of mushrooms or puffballs may appear overnight following warm summer rains or heavy watering.

No satisfactory control measures have been developed. Regular applications of cadmium or phenyl mercury fungicides appear to reduce their development.

Rust appears as yellow-orange or red-brown powdery pustules developing on leaves and stems. Wipe the turf with a white facial tissue or cloth and the rust-colored spores can be seen. Merion bluegrass was attacked in 1953 and again in 1954 in epidemic proportions.

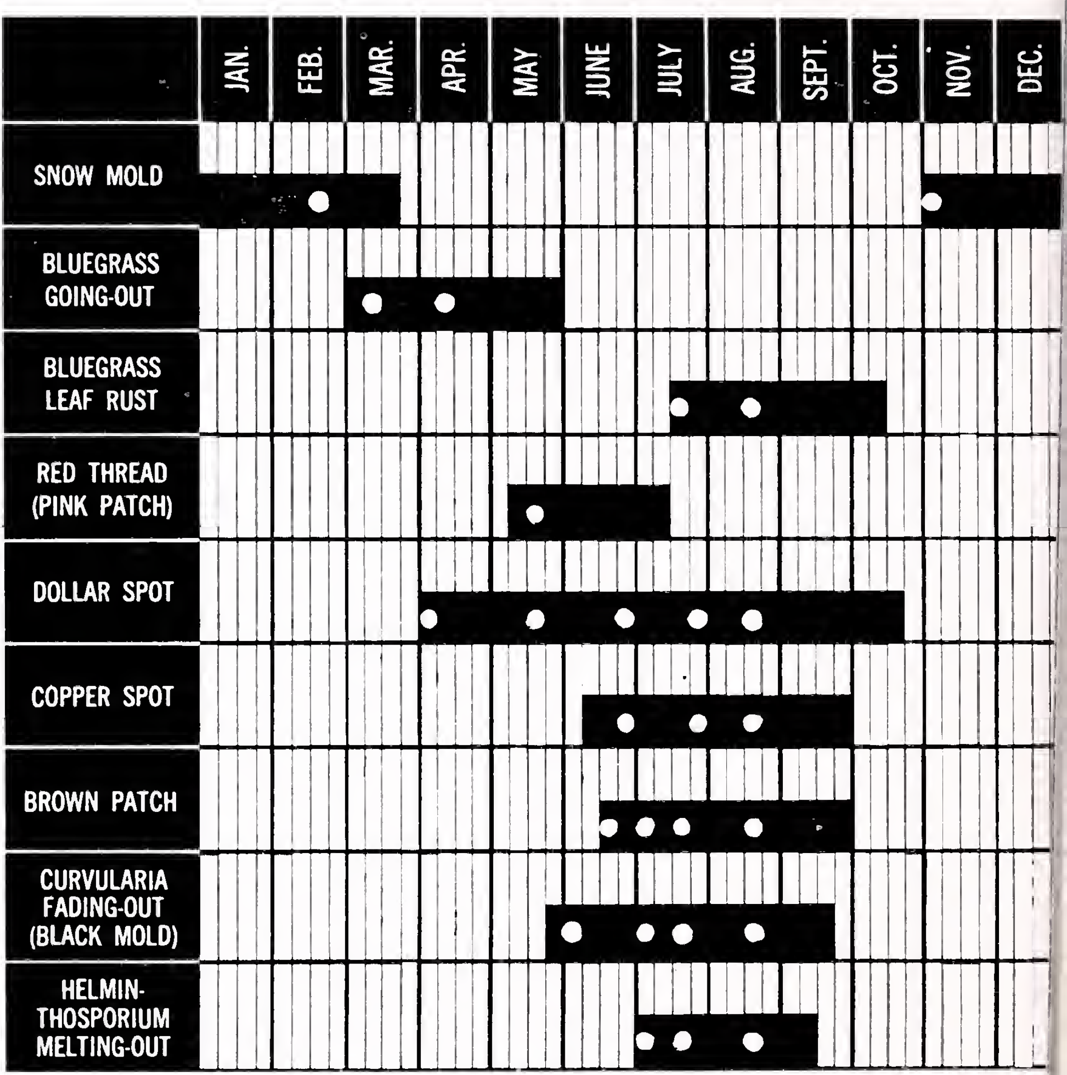
More specific fungicides are being developed, but meantime spray 2 or 3 times at 10-day intervals using dichlone (Phygon XL), zineb (Parzate or Dithane), maneb (Manzate), or cycloheximide (Actidione) according to the manufacturer's directions. These are protectants and should be timed to start about mid-July in the New York City-Southern New England region.

Slime mold. During summer rains a white or yellow slimy or gelatinous mass may move up and over a patch of grass. The slime mold dries out to form blue-gray or white, powdery spore bodies. The organism is not parasitic, but feeds on dead organic matter and at most shades or smothers the grass blades.

Brush over the affected areas and wash off the spores by watering with a hose.

We enjoy the green carpet of a lawn but usually do little to assist the plants to compete with their enemies. For those who take pride in and comfort from their lawns, the foregoing suggestions are made to maintain their healthy green appearance.

TURF DISEASE TIMETABLE



Courtesy Mallinckrodt Chemical Works

Black bands indicate times when diseases are active, white dots the times to treat. Periods that diseases are active are relative and vary with locality. Note that a single spraying may control several diseases which are active during the same period.

ROGUES' GALLERY OF PLANT ENEMIES

An illustrated "dictionary" of the most important diseases and pests

Cynthia Westcott

Unless otherwise indicated, photographs by author

PART ONE—PLANT DISEASES

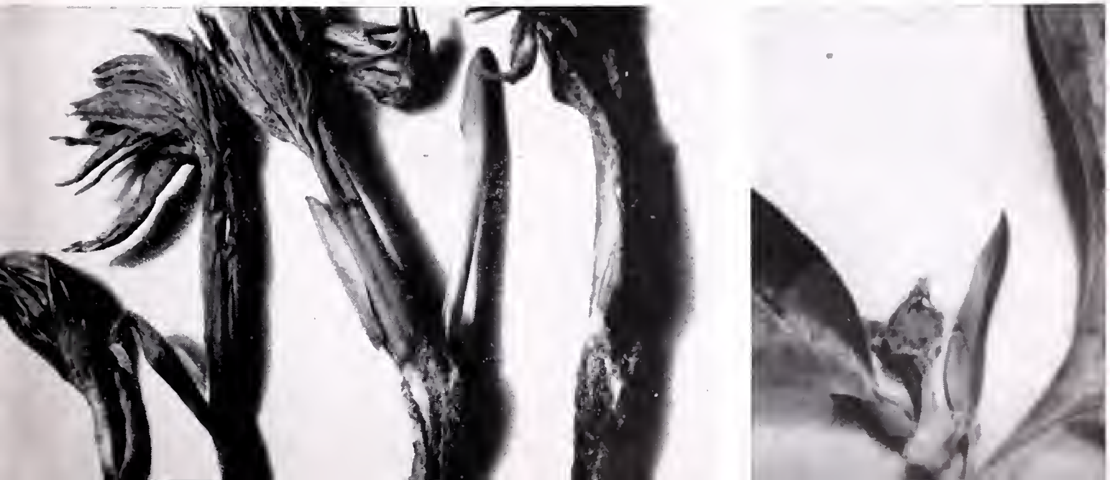
Blights

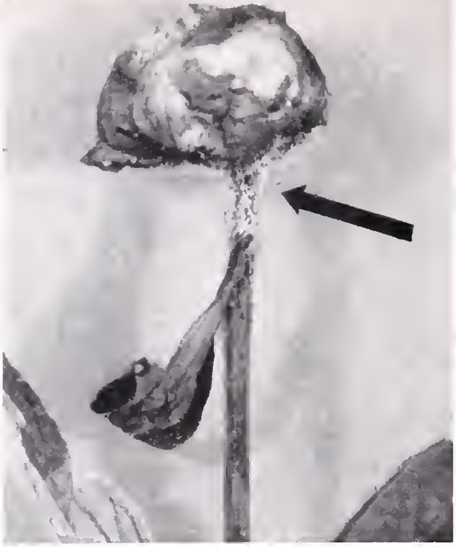
Blights are characterized by sudden death of shoots, foliage, flowers, or whole plants, caused by direct invasion of tissues by bacteria or fungi.

Fire blight. A bacterial disease making twigs and branches of pears, apples, quinces, crabapples, hawthorn, pyracantha and other members of the apple family look as if burned by fire. The bacteria swarm down inside the tissues below the part visibly blighted. Sanitation is the best control. Cut off infected branches at least 6 inches below the blighted portion. Antibiotics, especially streptomycin and terramycin, now control blossom blight in fruit trees and may become practical for ornamentals.

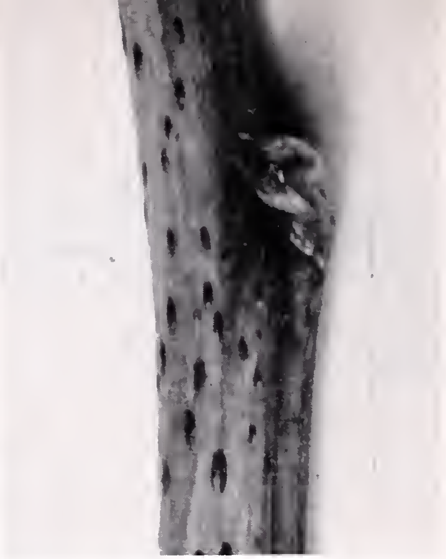
Botrytis blights. Various species of the fungus genus *Botrytis* cause blighting of tulips, narcissus, lilies (see article on pages 43 to 51) and peonies. In peony blight the fungus winters in flat black resting bodies (sclerotia) pressed against the lower part of the stem. In wet weather in spring these produce bunches of spores (the familiar gray mold) which infect young shoots coming through the ground, causing them to rot at the base. Later infection turns buds black and

Peony Botrytis blight. Left, young shoots rotting at base; right, black bud stage.





Peony bud blasted by Botrytis blight; gray mold (arrow) is typical.



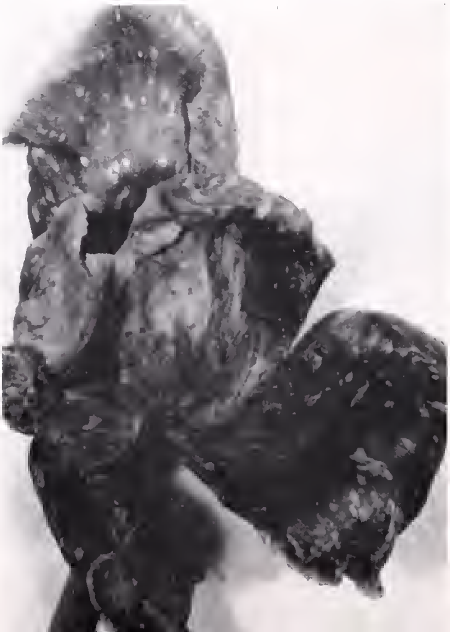
Botrytis blight over-winters as flat black bodies (sclerotia) on old peony stems.

blasts half-open flowers. Cut all stalks *at ground level* in October and burn tops. As soon as reddish shoots poke through the ground in spring spray with bordeaux mixture or ferbam. Repeat two or three times more at 10-day intervals.

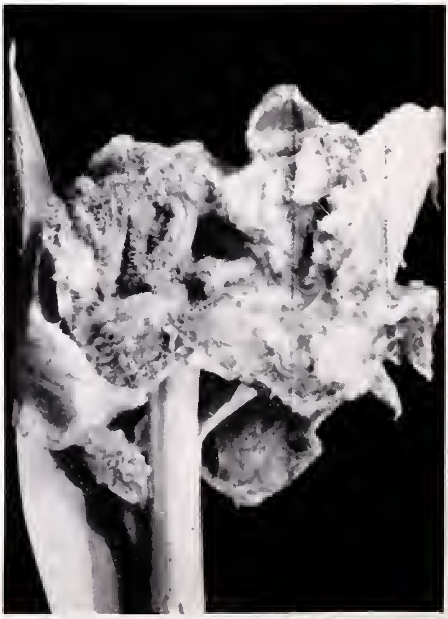
Two very serious flower blights, attacking petals only, are caused by fungi closely related to *Botrytis*.

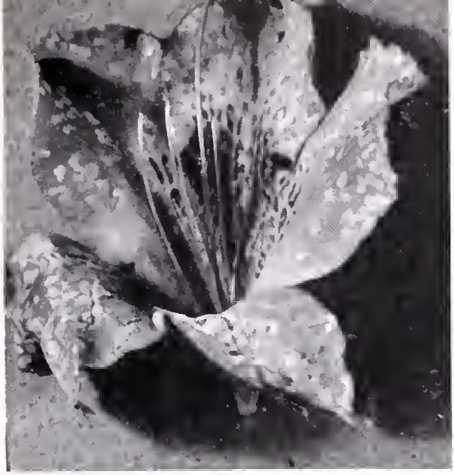
Azalea flower blight, also called flower spot and petal blight, is devastating from Maryland to Florida, around the Gulf to Texas, and in California. First symptom of disease is a white spot, slimy to the touch, that appears on a flower near the ground. Summer spores (conidia) formed inside the petals in moist weather are spread by insects, wind, and rain to other

Botrytis blight on tulip flower; each spot indicates where an airborne disease-producing spore landed from a neighboring flower.

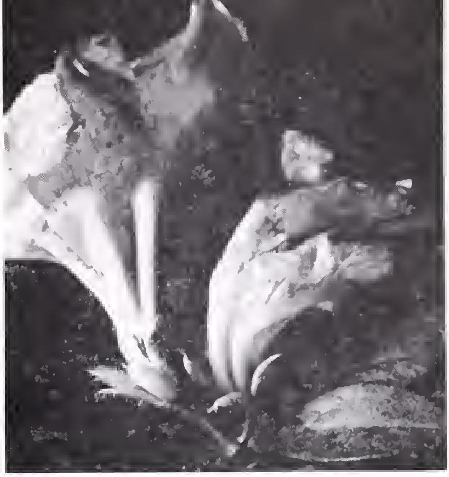


Advanced stage of infection; this ugly remnant of a tulip flower bears thousands of spores ready to infect nearby blossoms (also see page 44).





Flower spot stage of azalea flower blight.

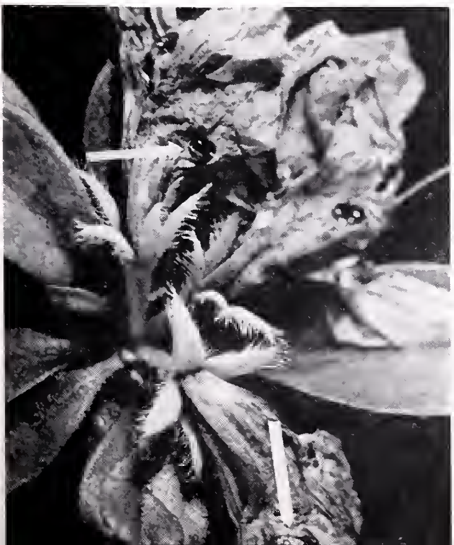


Preceding stage is quickly followed by collapse of flower to this limp, slimy stage.

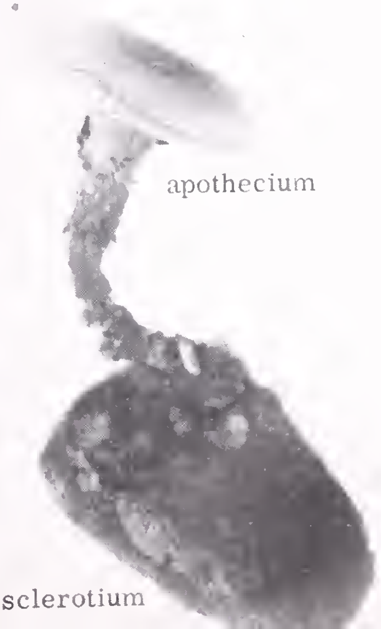
flowers, bushes, and gardens. Numerous white spots on colored petals, brown spots on white petals, show where each spore has landed but inside 24 hours the whole flower is limp and slimy and in a few more days of high humidity—rain, heavy dew, or fog—small, thin, slightly concave, black sclerotia form in the collapsed petals. Many drop to the ground, some remain in dry shrivelled flowers hanging on the bush for a year or more. In early spring, January to March depending on location, the sclerotia on the ground or in the mulch send up little stalks which open at the top to reddish-brown saucer-shaped objects, seldom more than 1 16th inch across. These apothecia are lined with clublike sacs, each containing 8 spores which are literally shot up into the air and to the lowest petals, thus starting another cycle.

It is impossible to visualize the havoc this flower blight can cause without

Fruiting bodies or sclerotia (arrows) form on the petals.



In spring sclerotia on the ground or on old dead flowers produce tiny mushroom-shaped growths (called apothecia) here enlarged about 24 times. These bear spores which are shot onto new flowers, starting the cycle over again.



Azalea bush protected from azalea flower blight by spraying.

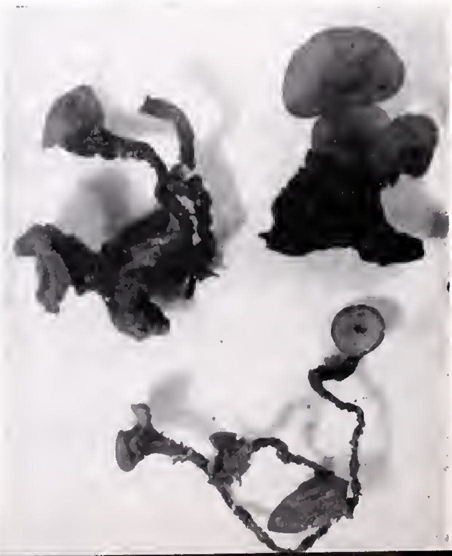
Untreated bush ruined by azalea flower blight.

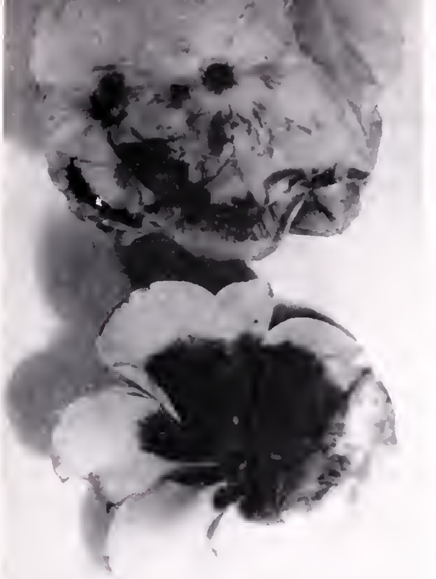
seeing it on the spot. All the flowers in a whole city seemingly turn to brown mush overnight; the big public gardens have to be closed and northern tourists go home disappointed unless a rigid spraying program is carried out. Nearly perfect control is now possible, however, by spraying three times a week for a month to 6 weeks, starting when mid-season varieties show color, with nabam or zineb (Dithane Z-78, 1 ounce to 5 gallons of water, or Parzate, 4/5 ounce to 5 gallons). In the large gardens spraying often prolongs the season several weeks and admission fees on a single day may cover the entire cost of spraying. The home gardener can spray or not as he chooses. It is quite possible to completely protect a few bushes even though those all around are blighted.

For this particular flower blight sanitation is useless. It does no good to pick off blighted flowers or clean up old mulches because the secondary spores (conidia) always bring in the disease from some neglected azalea in the neighborhood.

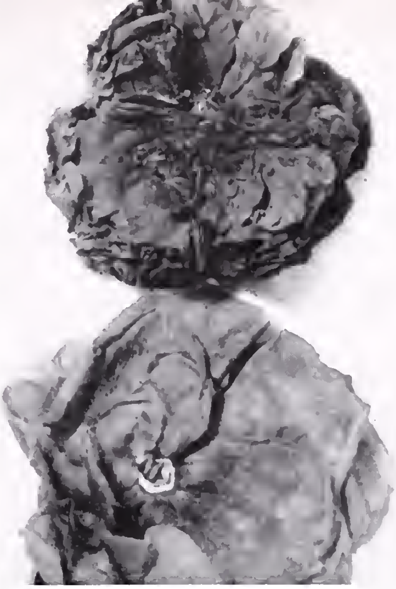
Camellia flower blight was first noticed in California in 1938 and apparently spread from there in soil around nursery stock before the first quarantine was applied in 1949. Now all of California, Oregon, and Virginia, and portions of Louisiana, Georgia, and North Carolina, are under a quarantine which prohibits movement of camellias except bare-rooted, with all flower buds removed. The fungus survives in soil or mulch under plants in the form of very large black sclerotia

These mushroom-like bodies (apothecia) of camellia flower blight play same role in perpetuating the disease as those of azalea flower blight but are much larger; they are shown here about life size.





Early symptoms of camellia flower blight.



Final stage of camellia flower blight; a hard sclerotium forms in center of flower.

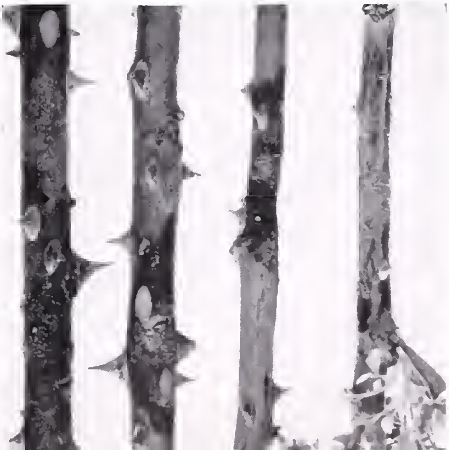
which, from January to March, send up mushroom-like apothecia, a half inch or more across, from which spores are shot to opening petals overhead. Symptoms start with small brown specks or a darkening of veins, with browning of the central portion of the flower. Soon the whole flower turns brown, but there is not the slimy feel of azalea blight. When infected flowers drop to moist earth the sclerotia formed at bases of the petals often form a compound structure.

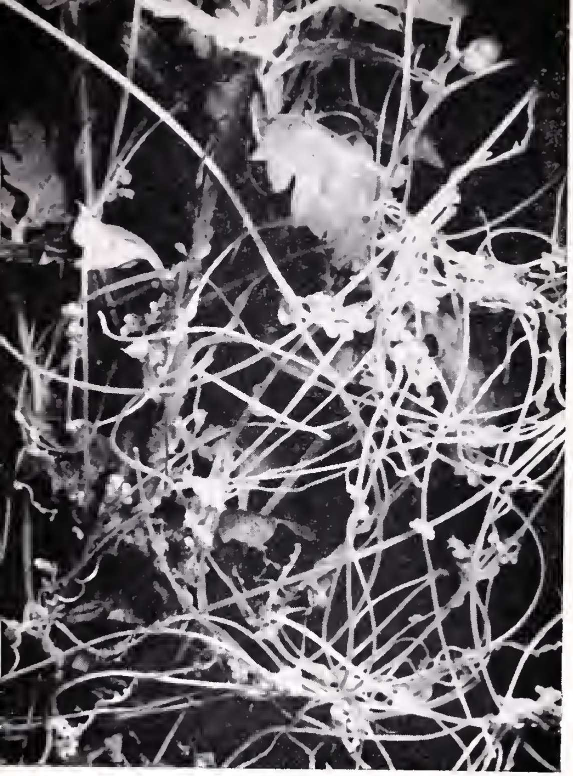
There are no secondary spores to be spread by wind and rain and insects so here sanitary measures are all-important. All fading flowers should be removed and burned as a precaution in any garden but on known infected properties in areas hitherto free from camellia blight quarantine regulations require that all flower buds be removed for 2 years subsequent to discovery of the disease; that all old mulch under bushes be removed with the top 3 inches of soil, to be replaced with a 4-inch layer of new soil or mulch; and that the area be drenched monthly from January to May with a solution of 1 pound Fermate to 25 gallons of water. Flying blossoms in for a camellia show has spread the disease in at least one instance. Most schedules now state that all exhibits are the property of the committee, to be destroyed on the spot at the end of the show. It has even been necessary to cancel camellia shows because of the presence of blight in the community.

Cankers

Localized lesions on woody stems, sometimes girdling the stem and cutting off the water supply, resulting in dieback. Some canker fungi are true

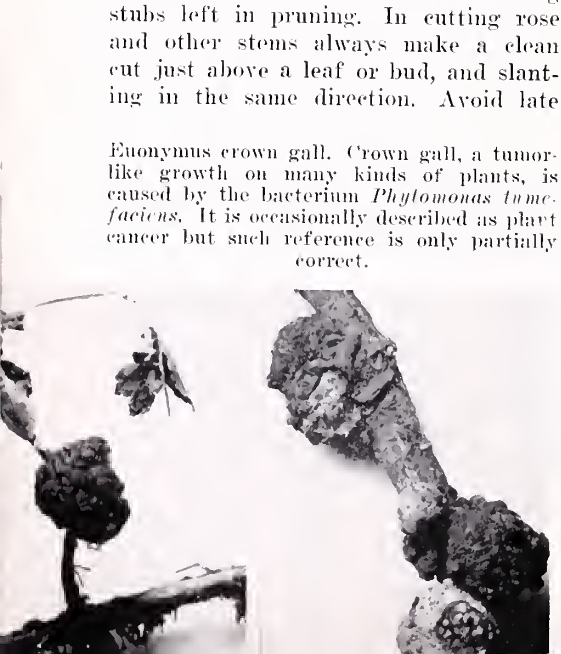
Brand canker of rose results in girdling of the canes.





Tangled mass of orange thread-like stems and whitish flowers characterize dodder, the one common flowering plant which is parasitic on other plants.

parasites, entering through unbroken tissue. Brown canker of rose, described in the article on rose diseases, is a good example of this type. Many other cankers are caused by fungi entering through insect wounds or frost cracks or long stubs left in pruning. In cutting rose and other stems always make a clean cut just above a leaf or bud, and slanting in the same direction. Avoid late feeding which produces soft tissue susceptible to frost injury. Avoid summer or winter mulches which keep canes too moist.



Euonymus crown gall. Crown gall, a tumor-like growth on many kinds of plants, is caused by the bacterium *Phytomonas tumefaciens*. It is occasionally described as plant cancer but such reference is only partially correct.

Dodder

A seed plant parasitic on many cultivated and wild plants. It is known also as love vine and hell-bine but is distinctly the latter. It is a leafless, orange, twining vine, without chlorophyll and so incapable of making its own food. It feeds by suckers sent into stems of chrysanthemums and other plants around which it is entwined and produces beautiful clusters of small white flowers. Dodder is quite common in gardens. I have found it most often on chrysanthemums but also on phlox, ivy, forsythia and many other plants. There is no control except to cut off all the plant parts on which it is growing *before* the white flowers set their seed. It does not do much good to pull off the tendrils because there is always a small portion left attached to the stem which starts to grow again.

Galls

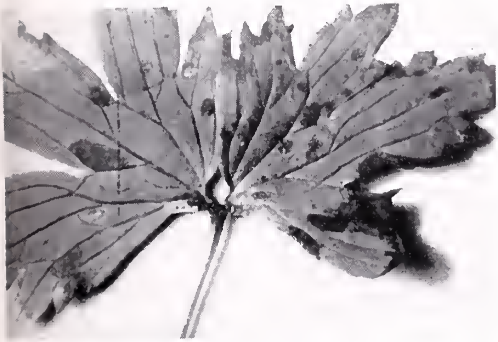
Abnormal enlargements of plant tissue due to stimulation by bacteria, fungi, insects, sometimes a virus. There is a marked excessive growth of cells as in human cancer.

Crown gall is a serious bacterial disease common on many plants but especially important on rose. The galls are rounded, with irregular, rough surfaces, from a fraction of an inch to several inches in diameter. The large galls are usually at rose crowns near the soil line, small galls more often on the roots. After a rose has died the bacteria can live in the soil a year or two, waiting to infect a healthy replacement. All roses received from a nursery should be carefully inspected before planting, and any showing galls rejected and not allowed to contaminate the soil.

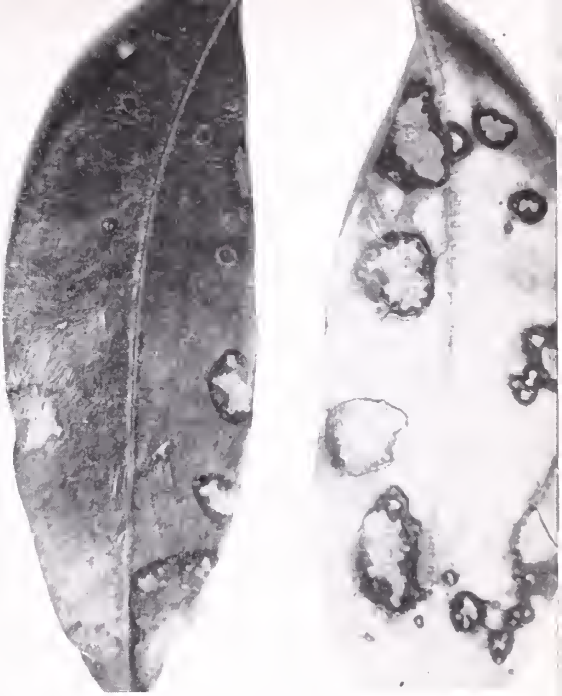
Sometimes crown gall is found on aerial plant parts, as on euonymus vines. Usually it is impossible to cut out the numerous galls without removing the whole vine which often lives for years even with the disease.

Leaf Spots

Definitely delimited spots on leaves, caused by hundreds of fungus species, most of which are not very important, though some may cause defoliation in a wet season. Rose black spot, undoubtedly the most important leaf spot of ornamentals, is fully discussed in the article on rose diseases, and iris leaf spot is considered both in the article on bulb diseases and the one dealing with bearded iris. Black spot of delphinium is a bacterial disease, quite unrelated to rose black spot. If leaves showing tarry black spots are removed and burned other control measures are seldom necessary.

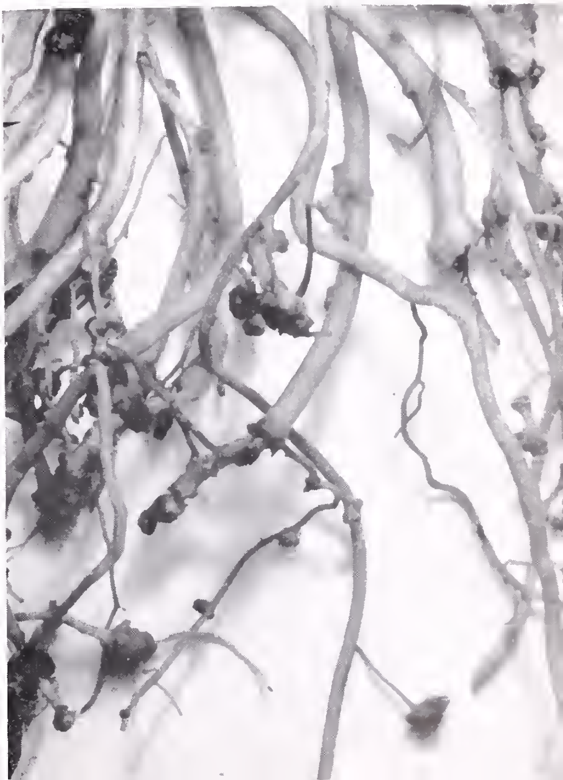


Black spot of delphinium, unrelated to rose black spot, can be controlled by removing and burning spotted leaves when they appear.



Leaf spots affect many plants; this unsightly one on mountain-laurel is more frequent on plants growing in shady or damp sites.

Root knot of many plants is caused by microscopic worms, nematodes, (see next page). More frequent in the south, it can cause stunting and death of infected plants.



Mountain-laurel is subject to a disfiguring leaf spot, more often when it is planted in the shade or under drip of trees, and Virginia creeper and Boston-ivy frequently have unsightly leaf spots. These can be somewhat controlled by spraying three or four times, starting when young leaves are unfolded, with bordeaux mixture or other copper fungicide or perhaps with ferbam or captan.

Nematodes

Microscopic, wormlike animals, also known as eelworms or roundworms, living in moist soil or plant tissue.

Root knot. Five or more species of *Meloidogyne* may cause knotlike enlargements in roots of many, many plants,

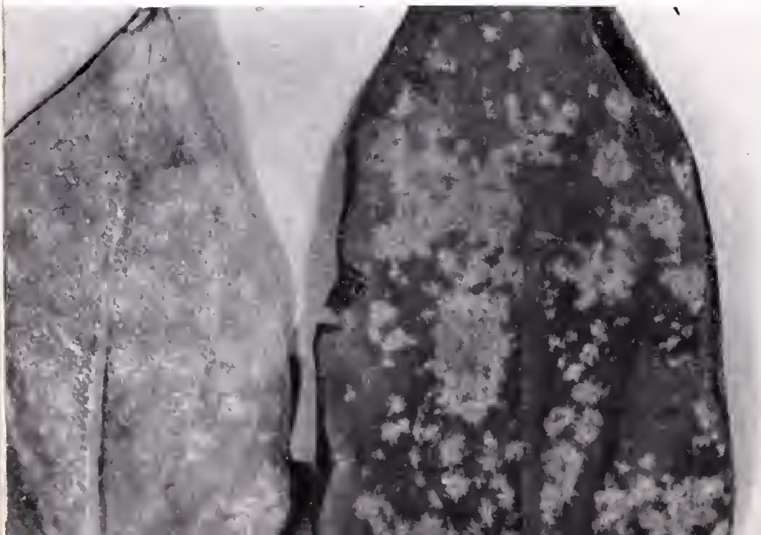
McWhorter

Living bulb nematodes enlarged 60 times.

with consequent stunting and sometimes death. Root knot is more common in the South but is frequently found in the North, especially in sandy soil, on clematis, peonies, and some other ornamentals. The nematodes can live for some time in the soil without a host plant but many of them are killed in cold northern winters. Control where possible by exclusion, refusing all plants showing knots on roots. Treat fallow soil with ethylene dibromide, which can be purchased in easy-to-use capsule form (Soilfume Caps) or with D-D mixture.

Bulb nematode. Common on narcissus. Foliage may be twisted or distorted, with leaves thickened near the base, marginal discoloration, and yellowish pimples (spikkles), or the foliage may be lacking. Bulbs have one or more brown rings between white, healthy scales or are entirely rotted. The nematodes enter the leaves when they emerge from the soil and are carried up as the leaves elongate. When foliage dries in summer, the nematodes work back to the bulbs where they overwinter. Commercial growers treat bulbs with hot water after digging. Home gardeners should remove and burn, or bury deeply and cover with quick lime, all infected materials and either plant new bulbs in a new location or sterilize soil with chloropicrin or D-D mixture.

Chrysanthemum leaf nematode. A wedge-shaped browning appears between the veins with eventual drying of the whole leaf. The disease starts near the soil and progresses upward until all leaves are hanging brown and shrivelled along the stem. The plant looks as if parched by drought but overhead watering is distinctly harmful, allowing the nematodes which live in the soil or in the crowns of old plants to swim up the stem. Do not divide old plants at the crown but make cuttings each year from healthy tips. Avoid overhead sprinkling and use a mulch. The soil can be treated with a solution of sodium selenate, made up to give ¼ gram of the chemical per square foot, but this poison remains in the soil. It would be dangerous to follow chrysanthemums with vegetables. Com-



Powdery mildew is very common on zinnia; note powdery undersurface of leaf (left).

mercial growers spray the foliage with parathion but that is too hazardous for amateur use.

Meadow nematodes. Several species feed on roots of boxwood and other shrubs. As the old roots die and slough off a witches' broom of shallow feeder roots is formed near the surface. Boxwood often turns a sickly bronze color. Extra watering helps the plant to compensate for the reduced root system.

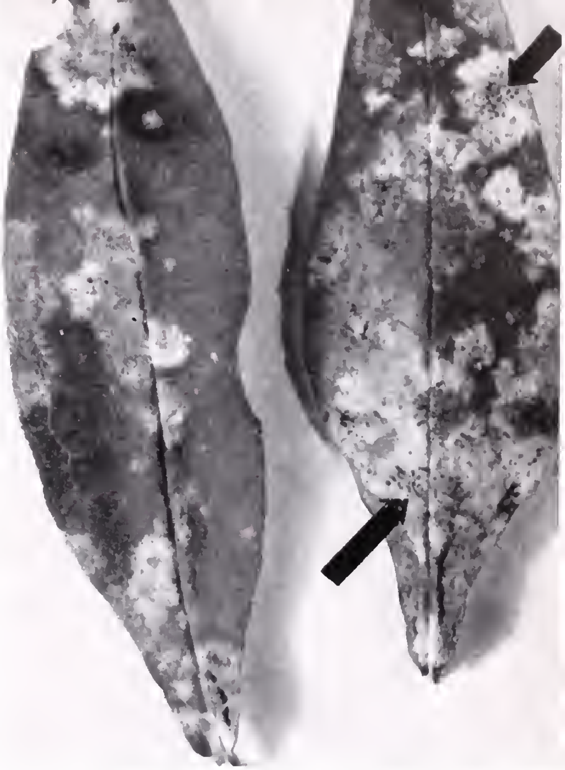
Powdery Mildews

Mildew is the name given both to the fungus and to the disease it causes. A white, sometimes felty coating formed on the surface of foliage, flowers, or stems is made up of a tangle of threads (mycelium) and chains of spores, the latter producing a powdery effect. In addition to these summer spores, many mildew species produce winter spores in minute, round, black fruiting bodies (perithecia) about as big as the point of a pin, anchored in the mycelium. There is often some dwarfing or deforming of plant parts. Mildews are common on a great many annuals, perennials, and shrubs, especially in locations where there is little air circulation. The spores germinate in high humidity but not in actual water and frequently heavy rains or syringing discourage the disease. Mildews can be controlled with sulfur or copper fungicides and with Karathane (Mildex) but not with ferbam, zineb, captan, and many other new chemicals.

Phlox mildew. Leaves and often stems are nearly covered with a white coating peppered with black dots. The same species attacks chrysanthemums and zinnias later in summer. Spray or dust with Karathane, sulfur, or copper, and cut and burn old stalks at the end of the season.

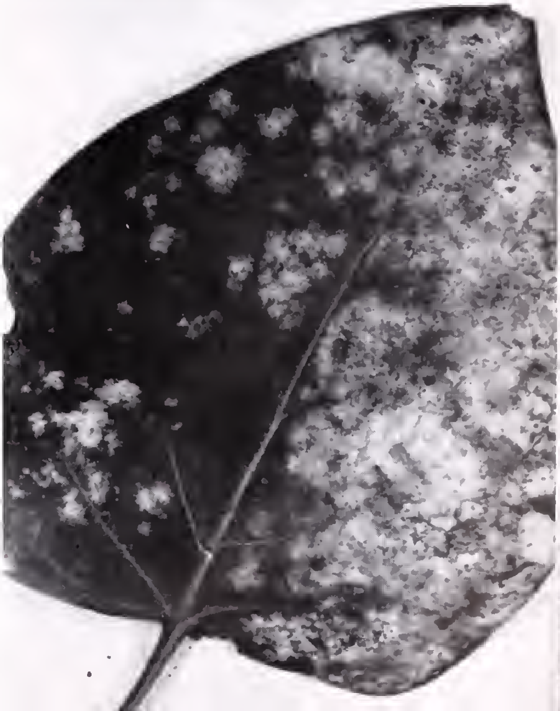
Lilac mildew. In August and September nearly all the leaves may turn dusty or white but the disease appears so late in the season it does little harm to the lilacs and the expense of spraying or dusting may not be justified.

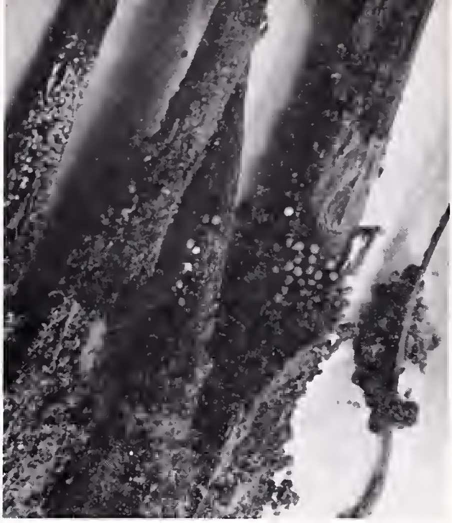
Rose mildew. See page 38.



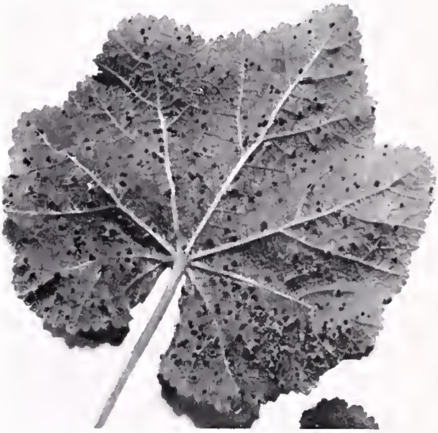
Powdery mildew of phlox; black dots (arrow) are reproductive bodies called perithecia.

Lilac mildew is ever present; though ugly it seems to do little harm.





Crown or sclerotic rot (see page 60) affects many annuals and perennials; here the mustardseed-like sclerotia are shown on delphinium.



Roche

Orange-red pustules of hollyhock rust on undersides of leaves.

Snapdragon rust; resistant strains of snapdragon can be used in the East.

Rots

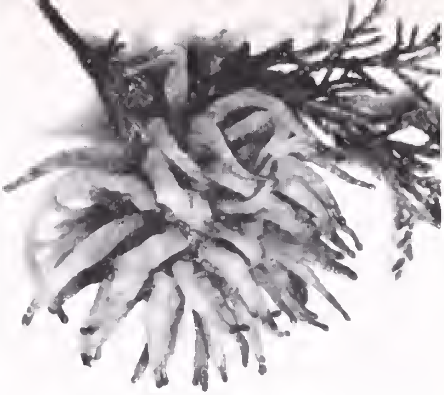
Hard, dry, or soft, wet decay or disintegration of plant tissues, usually of root, rhizome, or bulb, or stem or trunk, but seldom of foliage. Fruit rots are common, especially brown rot of stone fruits, where the fungus appears in little gray spore cushions over the rotting fruit, which eventually mummifies, turning wrinkled and hard. This disease attacks ornamental plums, cherries and peaches as a blossom blight.

Damping-off is the destruction of young seedlings by soil organisms, the sprouting seeds rotting before or soon after emergence from the ground. Seed treatment with Arasan, Spergon or Semesan is the easiest control measure.

Root rots. Several species of *Phytophthora* and other fungi living in the soil rot the roots of trees and shrubs in nurseries and home plantings, sometimes causing death. They are more dangerous in moist, poorly-drained soils and there is no very practical control. Put healthy shrubs in clean, friable soil and provide optimum cultural conditions.

Bacterial soft rot, a problem on root vegetables and also of iris rhizomes. See page 51 and page 59.

Crown rot is the northern name for southern blight, a disease common in warm, humid weather on a great variety of annuals, perennials and occasionally shrubs. Dr. Gould has described its effects on bulbous iris and Dr. Van de Water discusses it on German iris under the name sclerotic rot. In New Jersey it usually shows up with a spell of muggy weather in June, often first on *Ajuga*, the plants turning black. When a delphinium looks wilted, or sometimes topples over at the crown, you can usually see white fans of mycelial threads up the stem and the base, with surrounding soil covered with small round sclerotia, first white then reddish-tan, sometimes almost chocolate-brown. They can be formed as far down in the soil as the roots go and it is no easy task to take out a diseased plant and all surrounding soil, making sure that not a single sclerotium is left behind to cause trouble another year. I do the best I can, digging out onto thick layers of newspapers and rolling up plant and soil for the bonfire. Then I pour bichloride of mercury, 2 tablets to a quart of water, into the hole and over crowns of surrounding plants. It helps to prevent spread but is by no means a sure cure. It is folly, when crown rot appears in any part of the garden, to move plants from that section to another. It is also folly to accept gift plants from any garden with a known history of crown rot.



Brilliant orange, gelatinous spore horns of the galls of cedar apple rust on red-cedar appear only during rainy spring weather.

Rusts

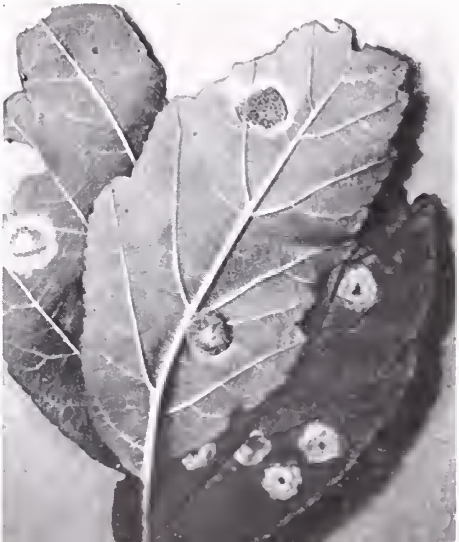
The rust-red color of spore pustules gives the name both to the fungus and to the disease. Rust fungi are obligate parasites with a rather complicated life history and four spore forms. Some live their lives on one type of plant, others have alternate hosts, producing two spore forms on one plant and the other two on a totally different type of plant.

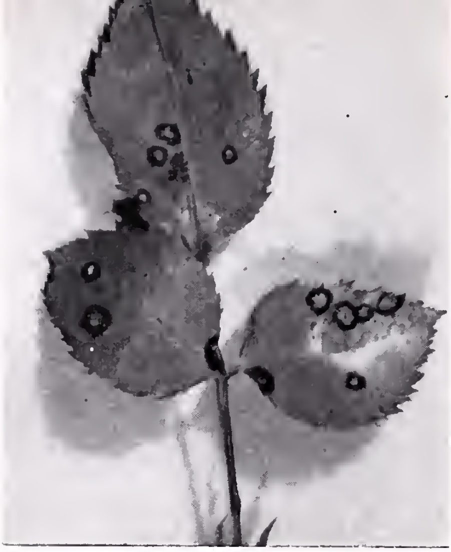
Hollyhock rust. Numerous reddish-orange pustules are formed all over the undersides of leaves, and often on the stems. The upper leaf surfaces are yellow over the infected portions. In severe cases leaves dry and hang down along the stem. Dust weekly with sulfur, starting very early in the season; remove diseased leaves as soon as noticed; cut and burn all old stalks after flowering.

Snapdragon rust has very powdery chocolate-brown spore pustules on undersides of leaves with a yellowing of the upper surfaces. There are several strains of this rust and while rust-resistant varieties of snapdragon can be relied on in the East they do not work so well on the Pacific Coast. There, spraying or dusting with zineb is recommended.

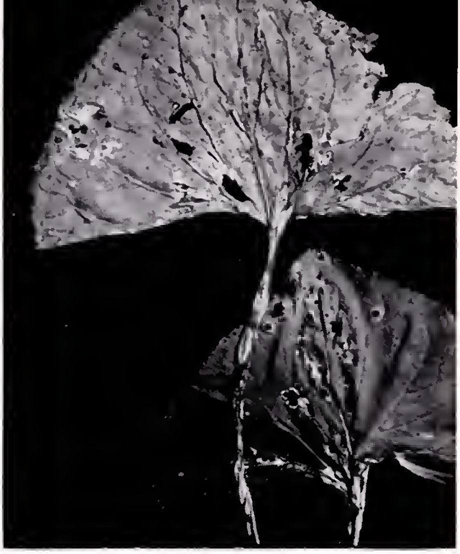
Cedar-apple rust. Galls formed on the needles of red-cedar (*Juniperus virginiana*) produce, in wet weather in spring, gelatinous orange horns, from which spores are detached and carried by wind and rain to leaves and fruits of apples and ornamental crabapples. Bechtel's and other native crabs are very susceptible, Asiatic varieties quite resistant. On the apple leaves in midsummer orange-yellow spots appear, bearing one type of spore on the underside of the leaf and another on the upper. The red-cedars are reinfected in late summer with the brown galls coming to maturity in about 18 months. There is little damage to the juniper but the apple host, which has stems and fruit as well as foliage infected, gradually declines in vigor. The farmer uses sulfur-ferbam in his spray schedule but the many treatments are difficult to manage on ornamentals. Don't plant red-cedars near crabapples and if you have them already be sure to cut off the galls in winter or very early spring before they send out their spore horns.

Apple leaves infected by disease-producing spores from the cedar gall develop orange and yellow leaf spots in summer.





Spot anthracnose spots have purplish margins; shown here on rose leaf, this disease often disfigures dogwood bloom.



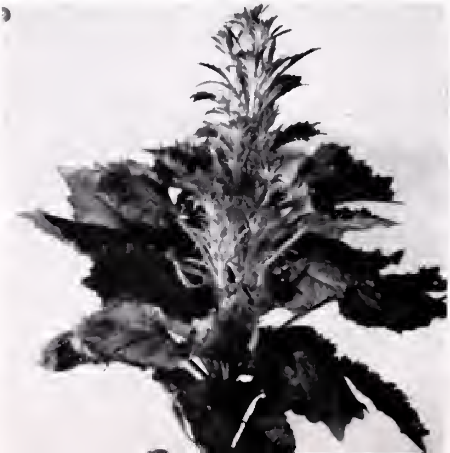
Violet scab may cause death and dropping out of infected tissue on violet leaves.

Spot Anthracnose

Light spots with reddish-purple margins on leaves, stems, or flowers, sometimes with a slightly raised or scabby effect. Dogwood bloom is seriously disfigured with spot anthracnose from Virginia to Florida and it is common on some rose varieties in central and northern New York, damaging canes and leaves more often than flowers.

Violet scab. This spot anthracnose is characterized by such definitely raised areas on leaves and stems it is usually called scab. The leaves are sometimes distorted and infected tissue may drop out, leaving holes. The disease is fairly prevalent through the South as well as in the North. Copper sprays have been recommended, also ferbam and zineb, but we really know very little as yet about control of spot anthracnoses.

Aster yellows, a common virus disease of asters, stunts and discolors leaves and flowers, producing a bushy-looking growth.



Virus Diseases

A virus is an infective material that will pass through the finest filter. It is on the borderline between living and non-living matter. In virus diseases there may be loss of color in definite patterns, mosaic, or a general chlorosis (loss of green color), or stunting. See pages 43 to 51 for narcissus and iris mosaic and "breaking" of tulips.

Aster yellows, common on asters and other annuals, is transmitted by leafhoppers. There is a stiff, much shortened growth, a yellowing of foliage, with flowers dwarfed and greenish. All infected plants should be removed and destroyed immediately. Spray or dust with DDT for leafhoppers.

Wilts

Systemic diseases with the tissues becoming flaccid because of plugging of the vascular system or a toxin introduced into it. The causative agent does not invade the entire plant. A tree can wilt at the top while the fungus is near the base.

Aster wilt is caused by a fungus, a species of *Fusarium,* in the soil. There is no cure, no way to prevent the disease by spraying or dusting but it can be avoided by planting wilt-resistant varieties. Another form of this fungus causes a wilt of sweet william and carnations.

Mimosa wilt, serious from Maryland to Alabama, has killed thousands of trees in North Carolina. The *Fusarium* lives in the soil but mimosa varieties resistant to it are now available.

Verticillium wilt. The same fungus that causes maple trees to die may infect aconite, chrysanthemum, and other perennials. If the stem is cut across, you can see a ring of black dots, the vessels of the now useless water-conducting system. The leaves die progressively up the stem but the plant may live for several years. Use healthy plants for propagation and start in a new location.

Fusarium wilt is difficult to combat except by using resistant strains of plants; here its effects on sweet william are shown (healthy plant in rear).

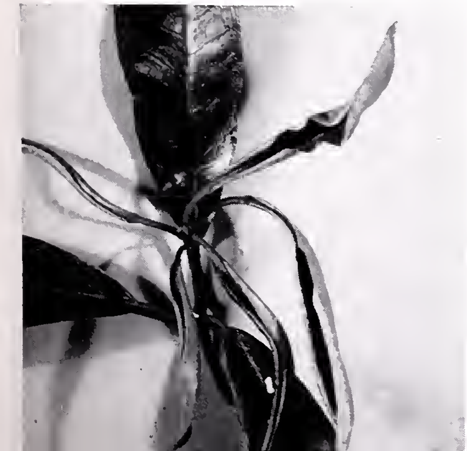
Weedkiller Effects

The most peculiar disease symptoms on plants sometimes trace back to the use of 2,4-D in the neighborhood, not always in the same garden and sometimes at quite a distance. The rose leaves pictured here were so deformed when a factory made up a weedkiller compound and the fumes came out of a tall smokestack and wafted over to a rose field several blocks away. In the past few years I have been finding a peculiar crinkling in leaves of certain rose varieties in a few gardens. I have no record of weedkillers being used near these roses but all the experts to whom I have submitted samples say that 2,4-D injury is the only explanation they have.

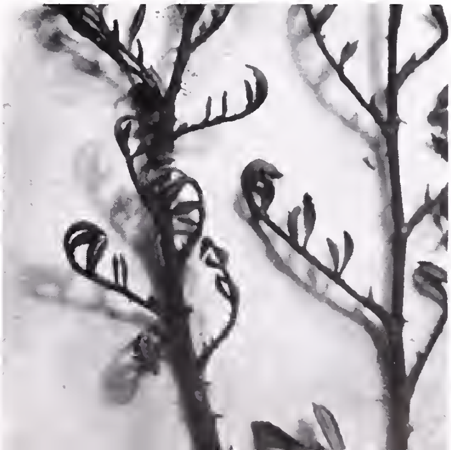
A year or two ago I was called in to diagnose chrysanthemums grotesquely deformed in an amateur greenhouse. They had used weedkiller on the lawn outside.

It is impossible to properly clean a sprayer that has once been used for 2,4-D. It can be rinsed several times, and ammonia solution (2 teaspoonfuls to a quart of water) allowed to stand in tank, hose, and rods for 24 hours and then rinsed, but if it stands for some time before being used again there is still the danger of injuring susceptible plants. It is always necessary to rinse the sprayer once more immediately before using but it is far safer to mark the weedkiller sprayer with red paint for danger and use another one for protective spraying on valuable plants.

Weed killer injury to rhododendron.



Fernlike growth of rose leaves due to vapor of hormone weedkiller fumes (also see page 9).



Ants

Except for the Texas leaf-cutting ants, these insects do more indirect than direct damage to plants. They make disfiguring nests in lawns and their nests in the garden disturb and often dry out the roots. Some ants carry off newly planted seed; many distribute aphids, herding them around to get the aphid honeydew; some, in the West, feed on natural parasites which keep mealybugs in check; some feed on the sticky secretion of peony buds but apparently do little damage; some may carry fire blight bacteria in the apple orchard but may also serve as pollinators. Chlordane has become standard control, either a 5% dust, or a spray of 1 to 2 tablespoonfuls 50% chlordane to a gallon of water, put into the nests and over the soil.

Aphids

Plant "lice" are small, soft-bodied sucking insects of many species and colors, feeding on succulent new shoots, on flower buds, inside curled leaves, on roots. They reduce plant vigor, cause various deformations, secrete honeydew in which grows ugly black sooty mold, and act as vectors of many virus diseases. Some have two hosts, wintering as eggs on a woody plant, then moving over to annual crops, producing many generations of living young before another egg stage. Most aphids are wingless but if the population gets too thick, winged forms develop for migration.

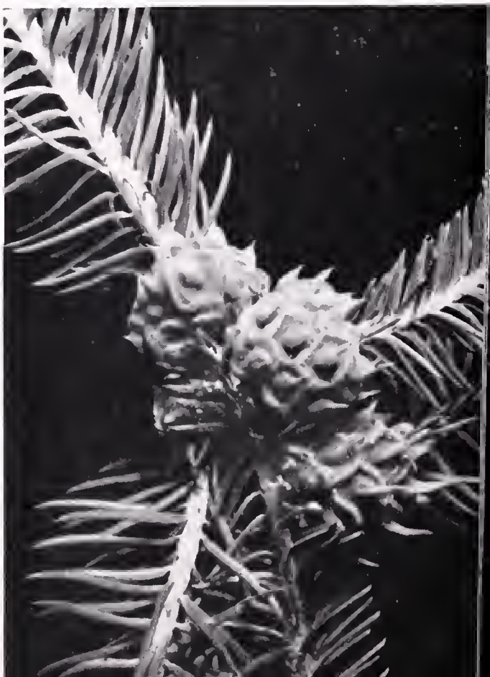
Old reliable nicotine sulfate (1½ teaspoonfuls to 1 ounce of soap and a gallon of water) is still a good aphicide and so is pyrethrum but the new malathion is favored by many. Lindane seems to be particularly effective for woolly aphids, such as the one on pine bark, and for the spruce gall aphids. Chlordane is probably the best bet for root aphids because it takes care of the ants that lug them around. Using DDT for aphids is not a good idea; it kills lady beetles, parasitic wasps, and other beneficial insects that keep aphids in check. For aphids on house plants the small "bombs" containing rotenone and pyrethrum are highly satisfactory.

Bagworms

Black and white caterpillars live inside spindle-shaped bags, 1 to 2 inches

Black bean aphids are almost always present on nasturtium; about natural size (also see page 26).

Aphids may attack roots, stems, leaves and flowers of plants; one kind causes these strange galls on spruce.



long, made of tough silk covered with bits of twigs from the host plants. They prefer evergreens, with arborvitae and juniper top favorites, but the bags are often found on pine, spruce, larch, and some deciduous trees and shrubs. The female stays always inside her bag, being fertilized there by the furry black male and laying her eggs, which do not hatch until very late spring. Then the young larvae crawl out and make their own bags as they feed.

The best control is to cut off the bags during winter or early spring. If this is impossible, spray in late May or June with lead arsenate, or possibly chlordane but not with DDT, which is ineffective.

Bees

The **leaf-cutter bee** is responsible for the circles and ovals cut from the margins of rose and other foliage. These perfectly tailored portions are cut to line their nests in the pith of woody plants. The disfigurement is common but there is little real damage and no good way to control an insect which does not take the leaf portions into its stomach. Cut out any dying stems that have been used as nests.

Leaf-cutter bees cut precise holes from leaves and cause some damage to rose canes into which they burrow, but usually are not a serious nuisance (see page 25).

Roche

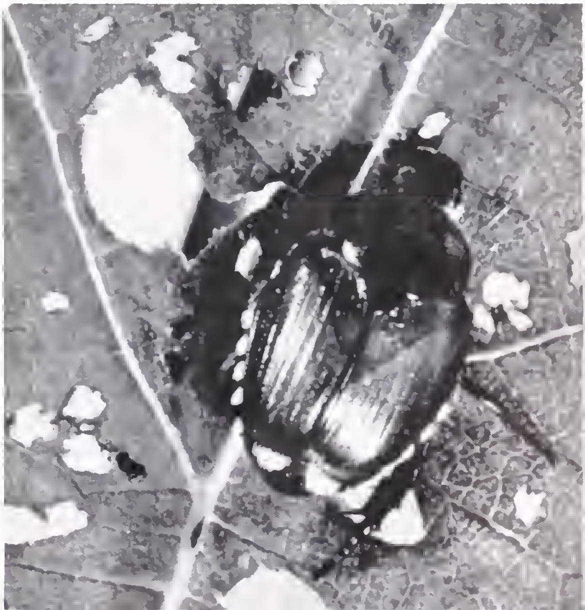
Bagworms prefer evergreens but are found on many deciduous trees as well; to control, cut off and burn the bags in winter.

Beetles

Beetles are chewing insects with a horny sheath covering membranous hind

Destructive Japanese beetles can be identified by their coppery green color and white tufts extending from under wing covers (also see page 23).

Roche



Larvae of Asiatic garden beetles live in the ground and destroy roots of plants.

Roche photos

Adult Asiatic garden beetle is about same size as Japanese beetle but is brown in color and feeds at night.

wings used in flight. The larval stage is a grub.

Japanese beetle. Now established in 15 states, Maine to North Carolina and west to Ohio, with scattered infestations in a few others. The beetle is ½ inch long, coppery green with tufts of white hairs extending from under the wing covers. The adults appear at the end of June, reach a peak in July, and gradually disappear in September. They feed on flowers and foliage of 275 different plants, being very partial to rose, hollyhock, mallow, canna, African (but not French) marigold, and zinnia flowers, and foliage of Boston-ivy and Virginia creeper. Eggs are laid in sod and the grubs, soft, dirty white, usually in a curved position, feed on grass roots, cutting them off so the grass can be rolled back like a carpet.

Regular treatment with DDT, methoxychlor, lead arsenate, lindane, and other compounds will usually keep foliage from being chewed to lace by beetles but it is hard to protect the flowers which open between sprays. Applications of DDT, chlordane, or dieldrin will kill grubs in lawns.

Asiatic garden beetle. Found only along the Atlantic seaboard from Massachusetts to South Carolina. The adult is about the same size and shape as the Japanese beetle but is rich chestnut-brown and works at night during the same months when its cousin feeds in sunlight. It feasts on dahlias, zinnias, asters, and other flowers. The grubs injure grass roots in the same manner as Japanese beetle grubs. The control measures are the same.

Various other beetles occasionally injure flowers. The **spotted cucumber beetle,** greenish yellow with 12 black spots, enjoys cosmos, shasta daisy, roses and other light colored blooms. **Rose chafers,** tan, long-legged beetles, are common on peonies and roses in early June. Long, slim, black **blister beetles** appear on asters and Japanese anemones in late summer. DDT or lindane will give fair control.

Borers

Larvae of moths, beetles, or sawflies work in woody or herbaceous stems, their presence often indicated by sawdust protruding through holes in the stem or trunk.

Lilac borer. Old lilac trunks are almost always full of borer holes and protruding sawdust. The caterpillar is white with a brown head, 1½ inches long. The wasplike, clear-winged moth emerges in late spring and early summer to lay eggs on roughened places on the bark, usually near the base. Spray trunks with DDT to prevent egg laying. Cut out old infested limbs. Kill borers in place with a wire or by squirting in carbon bisulfide.

Rhododendron borer. When rhododen-

Rhododendron branches die back as result of the working of rhodendron borer.

Four-lined plant bug causes round, depressed spots by its feeding on foliage.

drons die back look for borer holes along the larger limbs. The larva is yellow-white, about ½ inch long, the adult a clear-winged moth. Eggs are laid in June on twigs and larger branches. Inspect shrubs frequently, azaleas and laurel as well as rhododendron, and cut out branches below the infested portion. Spray or paint the trunks with DDT in late spring.

Rose pith borer. Sawflies and sometimes small wasps and bees lay their eggs on cut rose stems and the larvae bore down in the pith, causing die-back. Cut canes below infested part and burn. Paint large canes after pruning with tree paint or other compound. Avoid pruning back roses in autumn.

Bugs

Bugs are sucking insects of the order *Hemiptera*, "half-winged," so named because the upper half of the front pair of wings is thickened and stiff and the lower half thin and membranous. The wings are folded flat over the back when at rest. Lace bugs are probably the most important bugs on ornamentals.

Four-lined plant bug. The nymph is bright red, the adult greenish-yellow with four black stripes. Both stages suck on tender young leaves making round depressed spots, usually tan, sometimes dark, on chrysanthemums and many other ornamentals. Rotenone dust has worked well for me; DDT may be better.

Rhododendron lace bug. It is scarcely possible to grow rhododendrons in full sun without having the leaves stippled yellowish from lace bugs sucking on the undersurface, which is flecked with rusty brown. The nymphs are dark and spiny, the adults with beautiful lacy wings. There are two broods, the first appear-

Rhododendron lace bugs on underside of leaf.

Characteristic stippling of upper surface of rhododendron leaf, caused by lace bugs.

Hydrangea bud-worms tie tip leaves together and feed within the shelter thus made.

Familiar web of tent caterpillars is constructed in crotches of branches.

Larvae of minute flies called midges cause death of tips of rose twigs (see page 26).

ing in late May or early June, the second in July. Spraying with lindane soon after the nymphs hatch gives excellent control.

Azalea lace bug. This is similar to the rhododendron lace bug but there are more generations, with sucking continuing quite late in the fall. Evergreen azaleas frequently have all the foliage coffee-colored by midsummer. Spray with lindane or malathion.

Hawthorn lace bug. English hawthorn, cotoneaster, and pyracantha, especially in the South, are injured by this species.

Chinch bugs. Extremely small bugs, red with a white band when young, black with white wings when adult, suck sap out of crown, stem, and leaves of grass. Lawns turn reddish-brown in irregular patches. The grass cannot be rolled back as it can when grubs are at work, but the treatment, DDT, chlordane, or dieldrin, is the same.

Caterpillars

Wormlike larvae of moths and butterflies, smooth or hairy, ranging in size from less than an inch to the repulsive 3- or 4-inch hornworms. Many different caterpillars appear on ornamentals through the summer, eating holes in foliage and sometimes flowers. Some of them tie leaves together and feed from within this protection. Most can be controlled with DDT or lead arsenate.

Tent caterpillars. Burning out the nest may cause severe injury to valuable ornamentals. Wipe it out with a piece of crumpled newspaper, wrap it in more paper, and take to the incinerator. Better yet, find the brown, varnished egg-collars on the twigs in winter and cut them off.

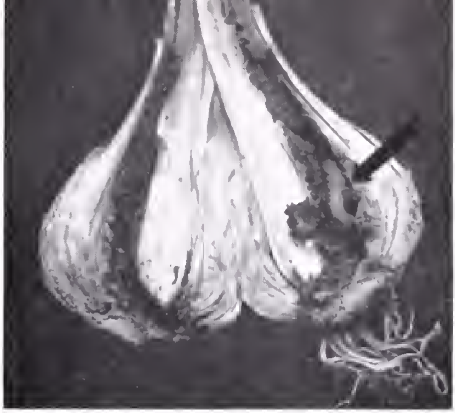
Cutworms are fat, greasy caterpillars, larvae of moths, that usually live curled up in the soil during the day and come out to cut off seedlings at night. Protect young transplants with a paper collar.

Flies and Midges

Members of the order *Diptera,* the adults having only 2 wings, instead of 4 like most insects. The larval stage is a legless maggot. The midges are small flies or gnats. Some of them, like the chrysanthemum gall midge, produce galls but are not often important in gardens.

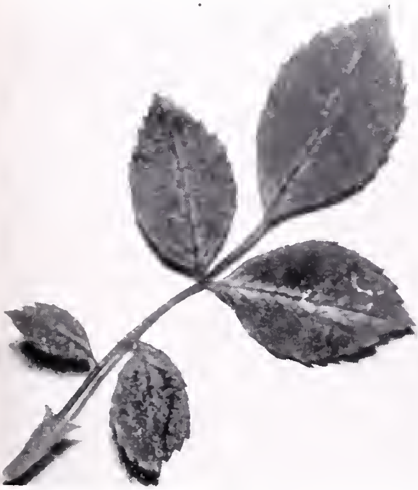
Narcissus bulb fly. The adult is a large, hairy, black fly up to ½ inch long, marked with gray, yellow, or orange. Infested bulbs contain a single, large yellowish maggot, ½ to ¾ inch, which reduces the interior to a thick brown mass. We usually think of this pest as a problem for western bulb growers but it has been found in New Jersey ruining amaryllis bulbs put outdoors for the summer. Plant only firm healthy bulbs.

Rose midge. Small buds turn black and crisp, usually in late summer, sometimes preventing all blooming. Cut off infested buds and spray ground and bushes with DDT. See also page 26.



Buhle

Narcisus bulb fly maggot destroys interior of narcissus and amaryllis bulbs.



When rose leaf appears stippled like this—

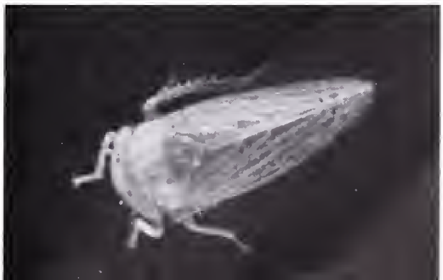
turn it over and find the tiny leafhoppers.

Leafhoppers

Elongate, wedge-shaped, sucking insects with wings held in a rooflike position. They work from underside of foliage, hopping away quickly when disturbed. Upper leaf surfaces show a very distinctive stippled pattern of white dots. The potato leafhopper causes a marginal burning of dahlia leaves and

Single leafhopper magnified 11 times.

Buhle

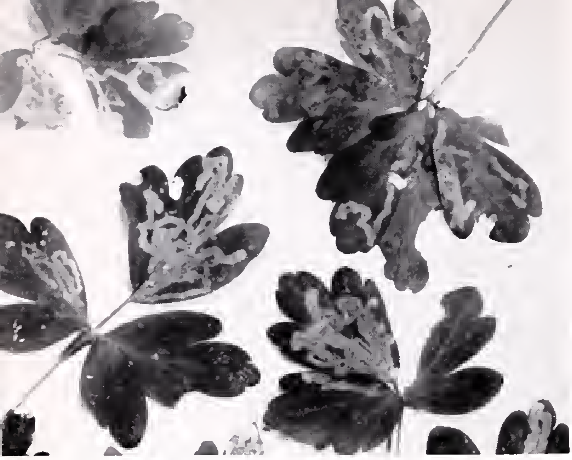


general stunting. Leafhoppers are vectors of many virus diseases. DDT usually gives excellent control.

Leaf Miners

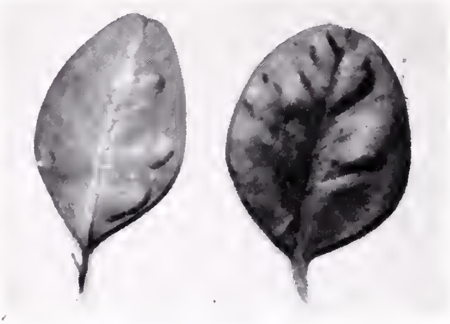
Insects which feed between two leaf surfaces making either blotches or serpentine mines or tunnels. See pages 16, 17, and 18 for boxwood and holly leaf miners.

Columbine leaf miner is almost always present in this plant and its white, winding tunnels are probably more conspicuous than injurious. Remove infested foliage; try DDT or lindane for control.

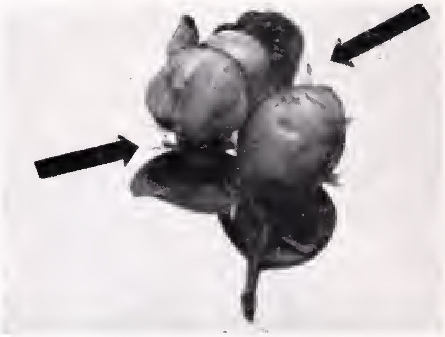


Roche

Familiar white traces of the columbine leaf miner.



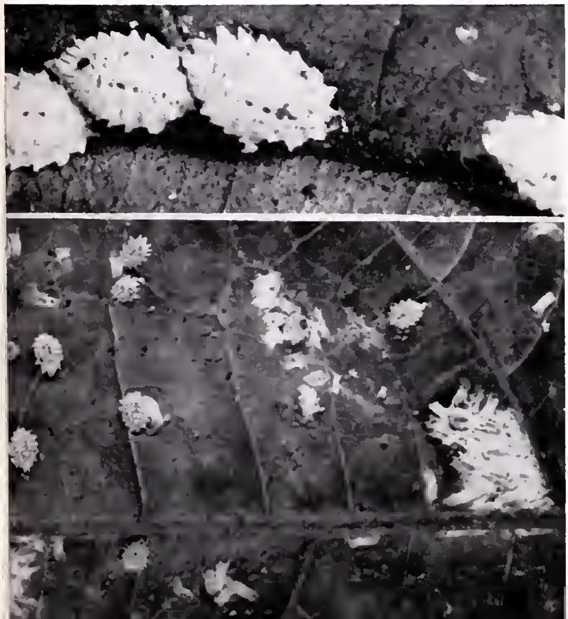
Blisters in boxwood leaves are characteristic of boxwood leaf miner. (Also see page 17).



Adult flies (arrows) of boxwood leaf miner laying eggs in leaves.

Mealybugs, common on house plants, are easily recognized by their white powdery appearance. Insert at top shows them enlarged 6 times.

Buhle



Mealybugs

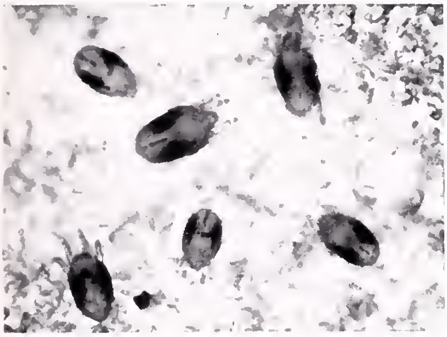
Small, sucking insects, often clustered at leaf axils, have flat oval bodies covered with a white, powdery wax extending in short projections around the body. Some species have pencil-like filaments at the tail. Eggs are produced in white cottony sacs. Many house and greenhouse plants are subject to infestation by mealybugs. Malathion is now suggested for control but one of the pyrethrum-rotenone "bombs" works fairly well if used before the infestations get too heavy.

Millipedes

Mostly scavengers feeding on decaying plants, sometimes injuring healthy seedlings. They are hard, wiry, cylindrical worms, grayish or brown, with two pairs of hairlike legs on each segment, usually found coiled up like a watch spring. They are often erroneously called wireworms but the latter are straight, not coiled, usually much larger and have only 6 legs instead of hundreds. Chlordane, DDT, and toxaphene are suggested for control.

Mites

Minute, sucking animals in the spider group, having 4 pairs of legs. Increasing use of DDT and similar compounds has enormously increased mite populations by destroying their insect enemies.

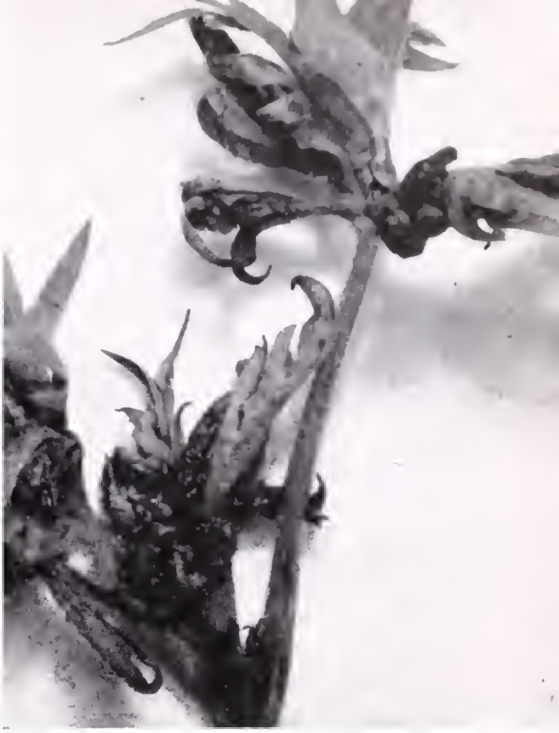


McWhorter

Two-spotted mites (common red spider) feeding on broadbean leaf; in this remarkable photograph the mites are enlarged about 30 times.

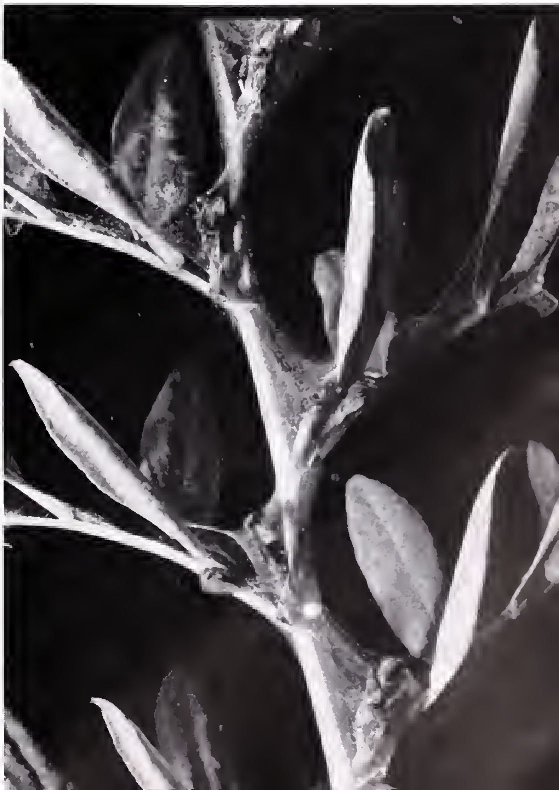
Cyclamen mite, too small to see with the naked eye, is a serious outdoor enemy to delphinium and indoors injures African violets and other flowers as well as cyclamen. The plants are stunted, the leaves thickened and of abnormal shape, and flower buds blackened. Dimite seems to give the best control but it is wiser to remove and destroy infested specimens.

Red spiders are about as big as specks of paprika and may be greenish or yellow more often than red. There are several species, with the two-spotted mite prevalent in most gardens. It turns phlox leaves yellow, rose foliage reddish, yellow, gray, or burned brown. There are usually cobwebs on the undersides of leaves, with black dots of excrement.



This injury to delphinium is caused by cyclamen mite, too small to be seen with the naked eye.

Spider mites, although barely visible to the naked eye, are recognized by these dusty-looking webs.



Base of flower stalk of hyacinth destroyed by bulb mites (arrow).

Aramite gives excellent control. Malathion, Ovotran, and chlorobenzilate are also recommended.

Spruce mite on evergreens. See page 21, Insect Pests of Ornamentals and Their Control.

Sawflies

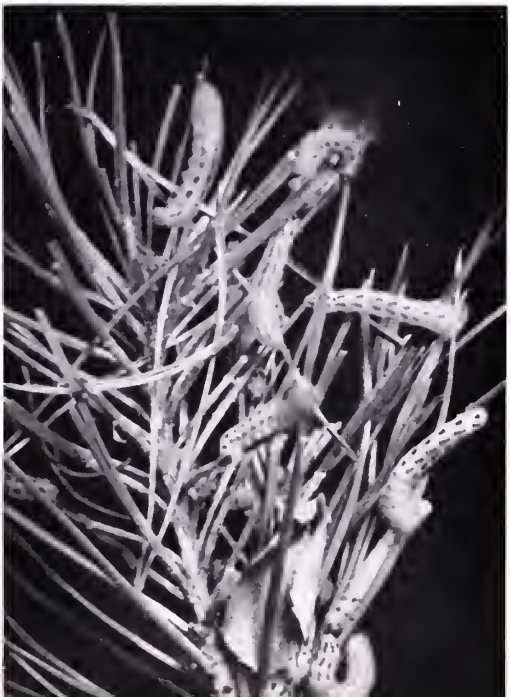
Related to bees and wasps. There are two types of larvae. One is soft and slug-like, quite small, the other more like a caterpillar. The adults resemble house flies but with two pairs of wings. The female uses a sawlike ovipositor to slit stems or leaves for egg laying.

Rose-slug. Leaves are skeletonized by tadpole-shaped, velvety green worms. See page 24.

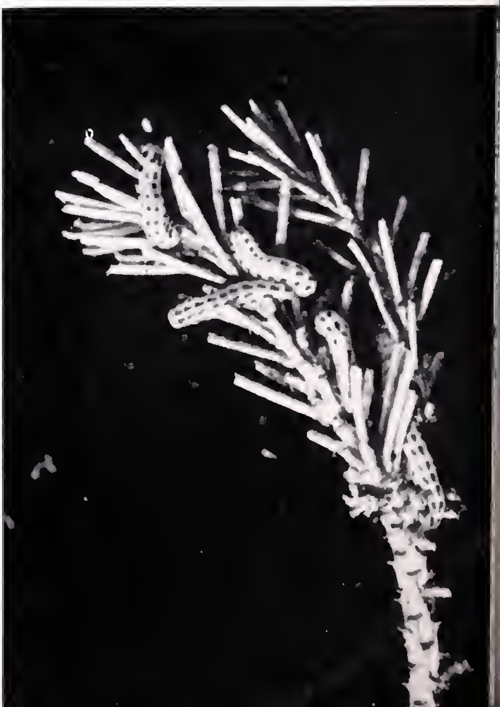
Pine sawflies. Several species play havoc with ornamental pines. The European pine sawfly hatches from eggs on the needles in late April and the larvae, green with shiny dark heads, work in gangs on the branches, chewing off all the old needles, leaving a brush of new at the tip. They stop feeding by June but the red-headed or Leconte's sawfly, yellow with black spots, chews through the summer. Either DDT or lead arsenate, applied *early* enough, gives adequate control.

Scale Insects

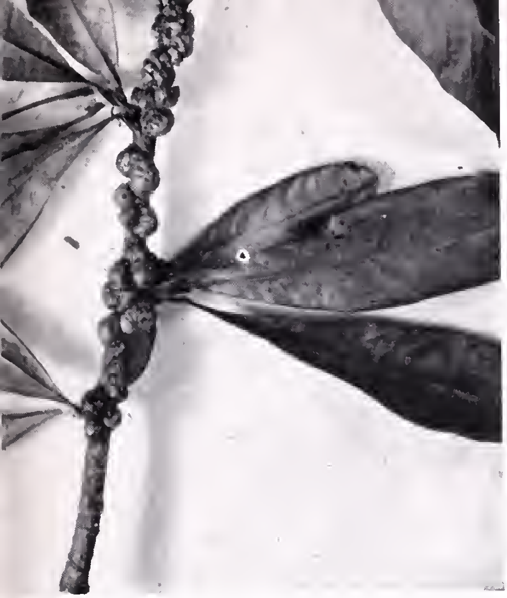
A very large and prolific group of sucking insects. The females are wingless and after a brief crawling stage stick in their beaks and settle down in one spot for life. The armored scales make a hard covering of molted skins and



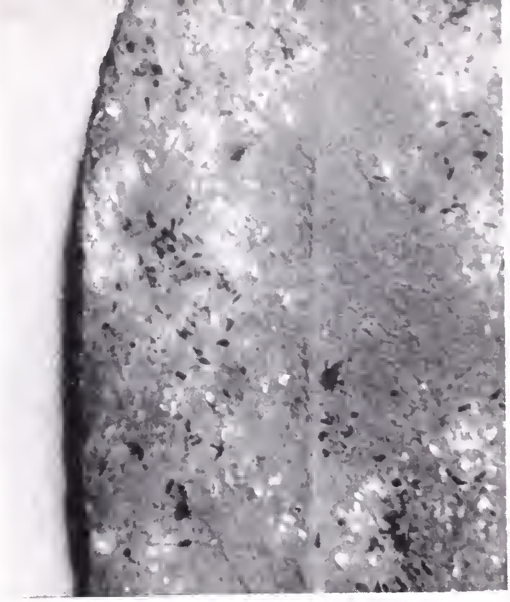
Larvae of Leconte's sawfly at work on pine.



After chewing off all the needles the "gang" is ready to move on to the next branch.



Twig of magnolia showing scale infestation.



Tea scale is a common pest of camellia foliage.

special secretions; the soft scales live without this protection. See pages 19, 20, and 21 for a discussion of oystershell, euonymus, juniper and taxus scales.

Magnolia scale is large, soft, very convex, brown, honeycombed with pits. It produces quantities of honeydew so that the magnolia leaves are often covered with black sooty mold. I have cleaned this up with a dormant oil spray.

Tea scale is very prevalent on camellias and Chinese holly in the South and may occur in northern greenhouses. The upper leaf surface is yellowed in mottled areas and on the under surface small, brown, boat-shaped females and white males are found in a tangle of white cottony threads. Former recommendations were to spray with a white oil, such as Volck, after the blooming period and again in September but then nurserymen found parathion very effective. For home owners the less dangerous malathion may substitute.

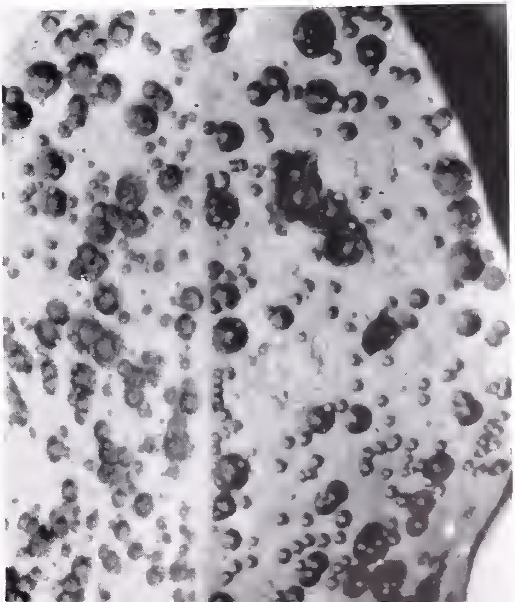
Florida red scale, small, round, dark brownish-red; **oleander or ivy scale**, circular, flat, pale yellow; and other southern scales are often found on indoor plants in the North. Remove and destroy infested leaves where possible; keep plants, especially ivy, washed off regularly; use Volck or malathion where necessary.

Slugs

Snails without shells, soft-bodied mollusks that leave a slimy trail behind them as they inch their way around the garden, eating large holes in leaves of

Florida red scale is a not infrequent pest of house plants in the North.

Buhle



Roche

Repulsive looking slugs chew holes in foliage of many garden plants and can be a great nuisance in greenhouses; they are best controlled by metaldehyde baits.

violets, hosta, hollyhock, and many other plants with leaves close to the ground. Metaldehyde baits are still standard control. These attract as well as kill the slugs but are also poisonous to birds, so it is best to place the bait under bits of board or jar covers. Chlordane is useful if placed where slugs have to crawl through it.

Sowbugs

Small animals resembling miniature armadillos. They are gray, oval, up to ½ inch long, with segmented bodies and 7 pairs of legs. One species called a pillbug or roly-poly rolls into a ball when disturbed. Like millipedes, sowbugs are mostly scavengers working on bulbs or roots already decaying from other causes but they occasionally attack healthy roots or stems near the ground. The poison bait concocted of Paris green and sugar is being replaced by dusting with DDT, chlordane, or toxaphene.

Greenish-colored spittlebugs live inside these frothy masses and suck juices from plants.

Roche

Spittlebugs

Spittle insects, sometimes called froghoppers and related to leafhoppers, live, as nymphs, in a frothy mass that looks like white of egg beaten up. Some species are rather damaging, especially to pine. Lindane seems to control the pest fairly well.

Thrips

Very small, slender insects with rasping mouth parts that scrape plant tissue and then suck the sap. They have wings like bristles.

Gladiolus thrips, chiefly on gladiolus, sometimes on iris and lilies. Foliage is flecked with silvery streaks and may turn brown; flowers are deformed, spotted or streaked; many spikes fail to open; corms are sticky, corky, and russeted. The thrips are yellow when young, black when adult. Dust or spray with DDT, starting when plants are 6 inches high and continuing every 10 to 14 days to flowering. Chlordane or toxaphene may be used in place of DDT. After harvesting and curing place corms in a paper bag, add a little 5% DDT dust and shake until well coated.

Flower thrips move over from flowers of weeds and grasses and trees to roses, peonies, and other flowers. Buds may blast and not open or the petals brown at the edges. See page 27.

Privet thrips make privet hedges in the East look as if covered with dust but can be controlled with contact insecticides.

Wasps

Most wasps are beneficial. They pollinize fruit trees and parasitize harmful insects but there are two very large species that frequently menace our gardens.

Digger wasp, also called cicada-killer, has a body 1½ inches long, black, banded with yellow, with a wicked stinger at the end. In late summer it can make a mess of lawns and even sidewalks, tunneling underground and marking the opening to each burrow with a mound of earth. The female wasp goes hunting for a cicada, drags it into her burrow, lays an egg in it, seals off the walls, and repeats the performance. The larvae hatch shortly, feed on the cicadas for a couple of weeks, then rest in a cocoon until the next summer when they emerge to scare everybody to death with their zooming around. Dust 5% chlordane dust into the holes or pour in a solution of chlordane, 2 teaspoonfuls 50% wettable powder in a gallon of water.

Giant hornet (Vespa hornet) is a little shorter than the digger wasp but a little stouter and hairier. It is dark reddish-brown with yellow markings and appears in late summer to tear the bark off lilac trunks and branches in irregular rings an inch or more wide. The hornets do a lot of damage in a very short time, using the bark shreds to make large, paper nests under the eaves of buildings, in hollow trees or in other sheltered places. Spray or paint trunks and branches with a strong solution of DDT if you see these wasps near lilacs.

Webworms

Caterpillars webbing branches or leaves together. The **fall webworm,** which first appears in June, is a hairy caterpillar that makes a nest somewhat like that of the tent caterpillar but over the ends of branches instead of back at the crotch. Usually it is easier to cut off and burn the webbed tips than to spray.

Pine webworms sew needles of white pine together in June. **Mimosa webworms** are serious on mimosa and honey locust in the South. Boxwood is occasionally webbed and pyracantha in Texas is almost invariably afflicted. **Sod webworms** live in tunnels just under the soil line and chew on grass leaves. DDT or chlordane dust or spray works well for most webworms.

The giant hornet strips bark from lilac branches to use in making paper for its nests.

Webworms spin their webs at the tips and along the branches of many trees, not just in the crotches as do the tent caterpillars.

Margins of privet leaves are scalloped by the privet weevil, giving a ragged appearance.

Weevils

Beetles with the head prolonged into a snout and usually with wing covers fastened down so they cannot fly. Most weevils live in the soil during the day, coming out at night to feed by notching leaves in from the margin. See page 21. Chlordane, lindane, and DDT are used for weevils.

Imported long-horned weevil is small, grayish, with long antennae, and feeds on many flowering and foliage plants. It also gets into houses.

White-pine weevil causes death of the terminal shoot. The injury is quite conspicuous as you drive through the countryside. Cut out the infested shoot as soon as noticed, well below where the yellow grubs are working, and tie a lateral branch up to a pole to make a new leader.

Whiteflies

Very small, sucking insects, that fly out in clouds from undersides of leaves when they are disturbed. The adults have 2 pairs of wings covered with a pure white, waxy powder. The nymphs look like very flat, oval scales. Whiteflies secrete a profuse amount of honeydew and as a result there is usually a luxuriant growth of velvety black, sooty mold on gardenias and other plants especially subject to infestation. Malathion is currently suggested for control; DDT has been used to some extent.

This Gallery of Plant Enemies only scratches the surface. There are myriads more insects and diseases that you may find on your own place, but the most common **types** of enemies have been given and you'll have to go on from there by yourself. I highly commend to you two publications of the United States Department of Agriculture, which you may obtain for $2.50 each from the Superintendent of Documents, Washington 25, D. C.—INSECTS, The Yearbook of Agriculture, 1952 and PLANT DISEASES, the Yearbook of Agriculture, 1953. There are many useful U.S.D.A. Farmers' Bulletins, sold for 5 cents and up, and your local Public Library undoubtedly has a set for you to look over. There is excellent material available free from every State Experiment Station.

Only the most recent books are anywhere near up to date on chemicals. Of these, I think you will find THE GARDENER'S ABC of PEST and DISEASE by A. W. Dimock (Barrows, 1953) and my own GARDEN ENEMIES (Van Nostrand, 1953) fairly helpful, but science has marched on even since they were written.

Whiteflies fly up from undersides of leaves when plants are disturbed; about twice natural size.

Buhle

Sooty mold which grows on leaves as result of honeydew from whiteflies, aphids, and some scales, disappears when insects are removed by spraying.

NOTE ON MATERIALS AND EQUIPMENT

Cynthia Westcott

Although most of you will be using spray and dust all-purpose mixtures and they have been mentioned repeatedly in the various articles, specific trade names have not been given and no definite recommendations can be made. That is because there are thousands of such mixtures on the market and the combinations sold under different brand names vary from year to year.

The Federal Insecticide, Fungicide and Rodenticide Act passed in 1947 requires all economic poisons to be registered with the United States Department of Agriculture. As of December, 1954, there are approximately 31,200 pesticides currently registered under brand names. You have to read the labels to know the actual chemical ingredients, many of which were unheard of even 10 years ago.

Pesticide Combinations

Ten years ago most rose dusts included lead arsenate and sulfur. Then DDT, rotenone, ferbam, and sulfur became the fashionable combination. When some of the evils as well as the benefits of DDT became apparent, some manufacturers switched to methoxychlor and when it was realized that both DDT and methoxychlor and perhaps other hydrocarbons encouraged mites, some formulators added Aramite or Ovotran or both. In the past two or three years lindane has been included in some mixtures, either in addition to, or as a replacement for, rotenone. In 1954 a combination of malathion, DDT, captan, and Karathane was presented for the first time. Some general garden dusts that include maneb, zineb or ziram are used on roses.

Aerosol Bombs

We have had aerosol "bombs" for household pests for some time but these easy-to-use pressurized sprays for plant pests are quite recent. They started with rotenone - pyrethrum combinations for house plants, then lindane for garden roses. This year at least two companies are offering a bomb including dichlone. This is an efficient fungicide but it has sometimes caused injury as a spray or dust. Perhaps it will be safer as a fine mist, perhaps less efficient—we'll have to wait and see. We do know that all such bombs are treacherous unless the operator stands far enough back from the plant to allow the oil or other carrier of the pesticide to evaporate before the spray hits the foliage.

The year 1955 may see a trend back to older materials. The United States Department of Agriculture has just released the results of its tests with rose dusts last summer. One containing old-fashioned sulfur and copper, combined with new Aramite, led the rest. A sulfur-copper dust has long been available in the Southwest; perhaps this report will help bring it to eastern gardeners. Many rose enthusiasts (including your guest editor) still use a three-in-one spray that combines old-fashioned lead arsenate, copper, and rotenone with the newer ferbam and Ovotran.

The advertisements do not tell you the formulations of the mixtures they are trying to sell (merely the miraculous results you are supposed to get) and the can on your dealer's shelf may be last year's formulation. To keep up to date on modern combinations write for the PESTICIDE HANDBOOK, Box 798, State College, Pennsylvania. There is a new edition each year listing pesticides and their formulations under trade names in alphabetical order. The 1954 edition (priced at $1.25) listed 5763 such products.

Pesticide Equipment

Sprayers vary from small atomizers to power sprayers of 12- to 150-gallon capacity. The compressed air cylinder is

Roche photos

Compressed air tank sprayers are handy for one operator and may be obtained in various sizes.

widely used, with a small 2-gallon size light enough for a woman to handle and a 5-gallon model on wheels also manageable for a woman who does all her gardening herself. Men may prefer a knapsack sprayer. Very practical for the whole garden, including shrubs and small trees, is the hand-pumped wheelbarrow-type sprayer but it takes two people to operate it efficiently. Trombone sprayers to put in a bucket and jars to be attached to the garden hose have their devotees.

Dusters range from a rubber bulb to power equipment. Dust guns of 1-pint to 2-quart capacity are relatively inexpensive and good for small gardens. New last year and exceedingly light and easy to operate is a midget rotary duster, worth the $10 it costs in the effort it saves. About the same price is a bellows duster, holding 8 pounds, which allows quick coverage of a large number of plants. And advertised for the 1955 season is a "split-gun" duster, to be held in one hand. It is said to throw a stream of dust 12 feet and sounds as if it might be more useful for shrubs and trees than for trying to cover the underside of rose foliage, but again we have to wait and see.

No one can pretend to cope with all the problems that come up on a home place. You do the best you can for your most important and expensive plantings and for your hobby plants, and then trust to Nature to take care of the rest. She is pretty tolerant but don't try her too far by rushing in without sufficient knowledge and experience. It is still true that you can kill a plant in 10 minutes while it may survive 10 years or more of neglect.

Wheelbarrow type pump sprayer is effective but requires two operators.

WITHIN THE BROOKLYN BOTANIC GARDEN

Second Award of the C. Stuart Gager Fellowship

Kanichiro Yashiroda, well known to all readers of PLANTS & GARDENS as the guest editor of the popular issue on Japanese dwarfed trees, has been named the second recipient of the C. Stuart Gager Fellowship at the Brooklyn Botanic Garden. Mr. Yashiroda recently arrived in this country from Tonosho on the island of Shodo in southern Japan, where he owns and operates the remarkable Acclimatization Garden, known to plantsmen all over the world. On April 5, he was given the Botanic Garden's Forsythia Award, in recognition of his horticultural work and its world role in furthering brotherhood, unity, and understanding among men.

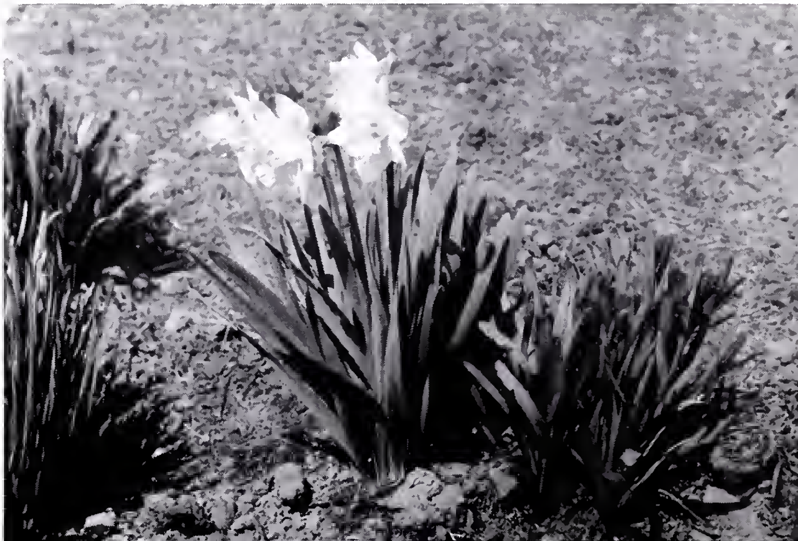
Kanichiro Yashiroda, left, instructs R. L. Maxson in some fine points of bonsai culture. Mr. Maxson flew from Grand Ledge, Michigan to Brooklyn to attend Mr. Yashiroda's classes in the art of bonsai.

While at the Botanic Garden, Mr. Yashiroda will conduct classes in the art of bonsai and will act as consultant to the Garden staff on matters pertaining to its own bonsai collection and its famous Japanese Garden. He also hopes to obtain plants of many varieties to take back to his collection in Japan.

Narcissus Virus Disease

A virus disease which has been tentatively identified as a narcissus mosaic has attacked the planting of naturalized narcissus on Daffodil Hill here at the Botanic Garden. Symptoms are a pronounced striping of the leaves, visible for only a few weeks in the spring, and a slight reduction in the number of flowers.

Since it seems likely that this disease is being spread among the plants by aphids, remedial steps being taken against the disease include spraying with DDT and nicotine sulfate to eliminate these insects. Individual diseased plants have been removed to some extent, but this presents an almost impossible task.



Narcissus plant at right, infected with virus disease, is delayed in blooming and shows fewer flower buds than healthy plant at left.

Buhle photos

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5

BROOKLYN BOTANIC GARDEN RECORD

PLANTS & GARDENS

ROSES

Culture
Winter Care
Pruning

Ideas for
Using:
Modern Roses,
Old-fashioned
and
Species Roses

SUMMER
1955

NEW SERIES
VOL. 11 No. 2

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PLANTS & GARDENS

Vol. 11 Summer, 1955 No. 2

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Editorial

Richard Thomson, *Guest Editor*
Peter K. Nelson, *Associate Editor*
and the Editorial Committee of the Brooklyn Botanic Garden

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Roche

What better way to use one's spare time than growing beautiful roses?

THE BROOKLYN INSTITUTE OF ARTS AND SCIENCES
BROOKLYN BOTANIC GARDEN
1000 WASHINGTON AVENUE
BROOKLYN 25, NEW YORK
TELEPHONE: MAIN 2-4433

Summer 1955

Without its blossoms, the rose plant would hardly warrant a second look. But add the flowers and it becomes one of the top favorites of the horticultural world. It is recognized as a rose by people who know no other plant by name. And whether grown by inexperienced amateurs or seasoned specialists, it probably offers a greater floral reward than any "bush" in the garden.

From the raw material of a few wild species, breeders have produced varieties that are numbered in the thousands, in almost every color of the spectrum. The fine hand of man has literally brought evolution to our doorstep; left to nature, the varieties might possibly have developed over aeons of time, but would never have survived.

Of all the families of ornamental plants that thrive in temperate climates of the world, the Rose Family probably enjoys the most prestige. And deservedly so. The genus *Rosa* is only one of its many groups. Among the other blossom-proud members are shadbush, crabapple, peach, and apricot — to say nothing of the magnificent ornamental cherries.

When our Editorial Committee asked Richard Thomson to guide the make-up of this Handbook on Roses, he responded with enthusiasm. And so did the authors he invited to share the responsibility with him. All of us here at the Botanic Garden are proud of what they have put together. May these 80 pages become a useful addition to the rosarian's reference shelf, and stir the interest of many who have yet to grow their first rose.

Sincerely yours,

George S. Avery Jr.

Director

Gottscho-Schleisner

Beds and trellises are basic for learning how to grow roses.

THE CULTURE OF THE ROSE

Is growing roses too complex for you? This article shows it need not be so

Richard Thomson

IT has long seemed to me that the subject of rose culture is made much too complicated, and that what information is available repels more potential rose growers than it entices. What follows will consist of the bare bones of the necessities which roses require, and will assume that the average rose grower is interested in roses for garden and home enjoyment, not in blue ribbons from National Rose Shows. Those interested in such competitive enterprises are referred to the many exhaustive texts available. Meanwhile, let's examine how we can grow roses to enjoy for ourselves.

Sources of Plants

Any nursery which grows its own stock and has sufficient experience to store and ship adequately packed plants can be regarded as trustworthy. There are many such, and no useful purpose would be served in recommending any specific firm. Roses grown in California, Arizona, Pennsylvania, Oregon, Ohio, etc., may be expected to perform equally well in all sections of the U.S.A. or elsewhere. The old fable about roses raised in warm climates being too tender for colder sections has been effectively exploded. Hardiness is a quality inherent in a variety, regardless of its source, so buy where you can get the plants you desire, and have no fear about where they were raised.

Spring Planting Versus Fall Planting

After years of serious experimentation in this line, it has become obvious that while fall plants start faster in the spring, by September first, spring and fall plants cannot be differentiated. But, spring plants must be planted early, as early as the ground can be worked. In the New York City area, this should be no later than the end of the blooming period of forsythia if best results are to be obtained. All of the above has to do with dormant plants. Potted roses? Try them if you wish, but results are apt to be extremely variable, depending on the skill with which they have been potted and brought along.

On Arrival

Plants will arrive from a reputable nursery packed in such a way that they will carry at least 2 weeks in the package without damage if kept shaded, moist, and cool. Should they arrive during a spring freeze, do not unpack. Open the top of the package, pour a glass or two of cool water into the bundle, and close up again. Keep them in a cool place until ready to plant. If the plants appear dry upon unwrapping, complete immersion in cool water for a period of 24 hours will usually remedy this condition.

Planting

When ready to plant, the average new rose grower becomes terrified and bewildered with the mass of information available on the subject. Let's face it, the purpose of planting is to get the roots under the ground where they belong. Given any reasonably fertile soil and fair drainage, the rose will settle in and produce acceptably. Failures are generally the result of stuffing a good root system into a tiny hole in soil which won't support a healthy weed, let alone a rose bush. The average rose will require a hole at least 2 feet long by 2 feet wide by 2 feet deep, one in which the roots may be spread out radially in their normal position. Roses should be planted in topsoil, with no fertilizer at all. It is best to obtain enough topsoil to take care of what roses are at hand to plant, and to discard what has been taken from the holes. Since rose roots grow down, like those of most plants, at an angle of roughly 45 degrees, it is necessary to build up a cone in the center of the hole, to support the center of the root system. With the plant in place on this cone of soil, and the base of the branching top of the plant level with the ground, not below, sift topsoil around the roots. When the hole is half filled, tread the soil firm about the roots. If the plant may be readily pulled free with one hand after this operation, it is not firm enough, so repeat. Then fill the hole half full of water. When this has drained away, fill the remainder of the hole with topsoil, and heap up the old soil removed initially from the hole around the base of the plant. When growth starts, gradually remove the soil heap to ground level. If it doesn't grow after this relatively simple planting operation, send the plant to me and I will eat it, thorns and all.

Situation

Any place which gets at least 5 hours of sunshine, and one where it isn't necessary to blast to get through matted roots of other plants is good for roses. Once established, a rose will compete successfully with most shrubs and trees, even in close contact with them.

Fertilizers

More roses have been killed from over-fertilizing than from any other cause. Water is the best "fertilizer," and must be used very freely. Water the ground, not the plants. Water on the foliage will induce disease, and does the roots no good in any case. Allow the hose to run gently on the ground until the soil is soaked to a depth of at least a foot (probably at least a half hour) before moving it to a new location. During spring and fall rains, obviously, less artificial watering is needed, but during the annual summer drought, copious water is needed if bloom and growth are to be maintained. Small amounts of commercial fertilizer may be used after the plants have been established for several months, but be sure to use one quarter to one half of the manufacturer's recommendation. (The manufacturers will hate me for this.) If your rose seems to be in trouble, try more water, not fertilizer.

Diseases

Don't go away; diseases aren't so bad and can be controlled. (See PLANTS & GARDENS, Spring, 1955.) There is only

Well-packed rose bush can if necessary be kept in package for as long as 2 weeks by keeping cool, shaded, and moist.

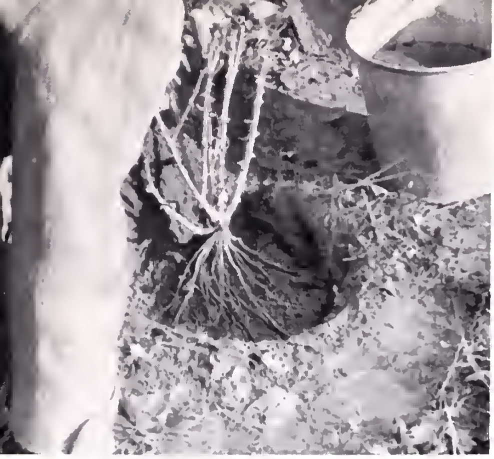
A good nursery-grown bush deserves a hole 2 feet across and 2 feet deep; cone of topsoil is placed in bottom.

one really bad one, and in a small garden it can be controlled without too much effort if you are vigilant. Often, in early or middle summer, a plant will break out with a rash of spotted leaves. The spots are black, with a fibrous edge, which if allowed to spread, will turn all infected leaves yellow and defoliate the plant. The secret is to protect the leaves from infection by keeping them coated with a film of preventive spray. This means a regular weekly program of spraying or dusting which may consume all of 10 minutes in a smaller garden, so don't feel enslaved by the prospect. When you see a black-spotted leaf, pull it off and burn it, to reduce the chance of infection of other leaves. These infectious fungi are transferred by splashing water, thus the importance of keeping artificial watering away from the foliage. The other relatively important foliage disease, mildew, is more unsightly than important. Leaves and stems develop felty white patches which may distort the growing tissues. This will succumb to the same general-purpose spray program outlined above. For general use, sprays and dusts containing Captan and Mildex (Karathane) seem more efficient than most. Look for these ingredients on the side of the package when you buy. Only one note of caution: when temperatures approach 90°F., do yourself and the rose a favor, and don't spray or dust. The spray may burn the leaves at these temperatures, so take a rest until it cools off. (See PLANTS & GARDENS, Spring, 1955.)

Pruning

Inevitably, the season ends, and the novice is uneasily aware that something should be done. He isn't quite sure what or when, but something should be done. So he descends on his roses, shears in hand, and proceeds to "prune." What happens could be done just as readily by a wandering goat, and with equally dire results in most cases. Relax! The rose won't die if it isn't pruned at all, and will thrive if it is pruned relatively little. Like most woody plants, a rosebush will do better if it is not chopped nearly to the ground each season. (Also see page 105.)

Seriously, don't prune at all in the fall, except to top tall canes which may whip in the winter winds, and gash other growth with their thorns. In any case, don't cut shorter than 3 feet in the fall. In early spring (in my own case February 15th to March 15th) rose plants should be thinned out and pruned to a desired shape. In the case of a plant which has produced several good canes during the preceding season, all older wood may be cut out at the base, and the new wood shortened to suit. If the variety is one



Roots are spread over cone of topsoil; branching crown of bush is set even with ground level.

Soil should be firmly packed around roots when hole is half-filled.

which has produced new wood up on an older cane, cut the old wood out above the place where the new emerges. In a situation such as this, cut close to the new wood, leaving as little stub as possible. Try to leave your plant with at least 2 feet of new canes, arranged as symmetrically as possible around an open center. Never cut the new wood back to a place where it is thicker than your little finger. Such a high- or medium-pruned plant will produce far more and finer blossoms than one cut nearly to the ground. There are sound botanical reasons why this is so, but this is not a professional treatise. If you want to be fussy, paint the cut ends of the canes and wood with tree wound paint. This will insure against a malevolent insect which may bore a hole into the center of the cane, thereby scaring you half to death. Actually, the cane will continue to produce pretty well anyway, hole or no hole, so relax.

Pruning becomes an art, and you will learn from experience just how each plant should be handled. If you make a mistake, the plant won't die, and in time you will discover just what will produce the most and the best blooms. Don't be afraid to experiment—no hobby is fun if there must be ironclad rules. What I have written here is to get you started on the right foot. Now you're on your own!

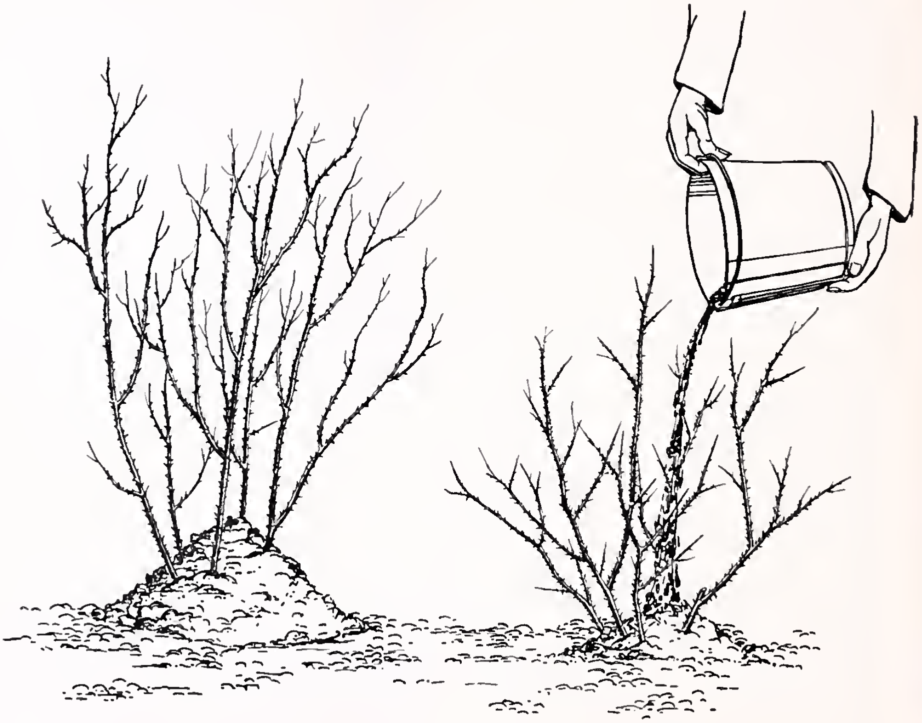
Remaining hole is filled half full of water; when this drains, filling with topsoil is completed.

Soil is heaped up around base of plant; as growth begins, this mound is gradually removed.

Roche photos

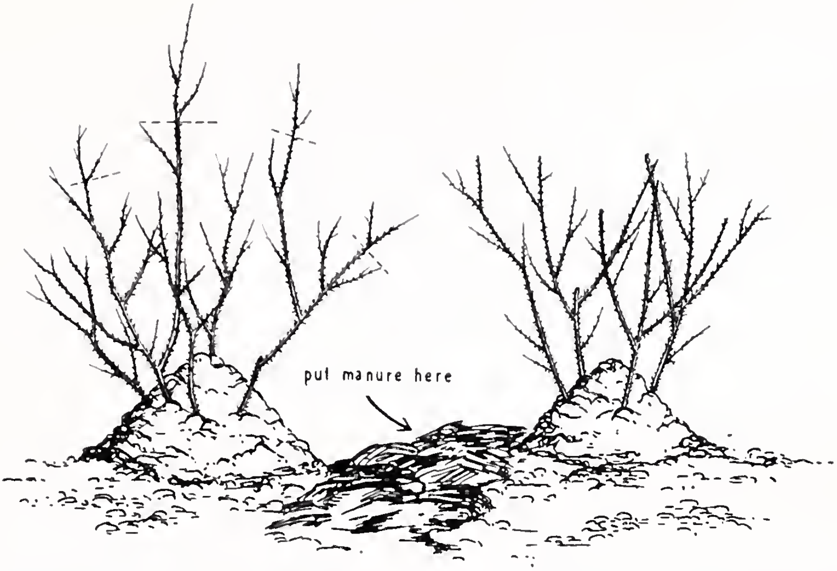
WINTER CARE

In more northern parts of the United States roses need some winter protection. Experience of growers all over the country indicates that the best protection is to hill the bushes with soil, preferably a mixture of half soil and half compost. Height of the mound varies from 5 to 12 inches or even more, depending upon the severity of the climate. Hilling may not be sufficient for Hybrid Tea roses in the coldest regions. In these places some growers take the bushes up and bury them in a trench, others wrap them with oilcloth or other waterproof material.



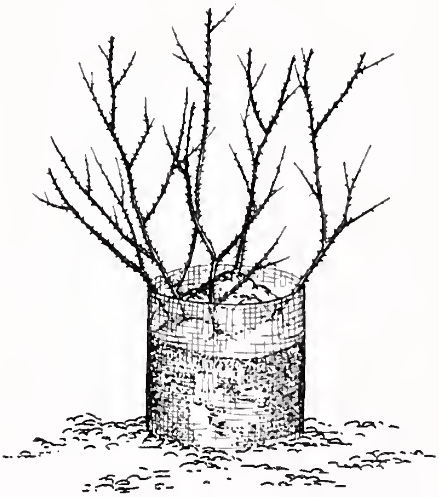
Of primary importance is to have the bushes enter the winter in good condition—so summer care is a factor in winter protection.

Soil for hilling should be brought in from outside, not scraped from between the bushes as this may expose and injure roots near the surface. Pour soil into center of bush to form mound.



Heavy fall pruning should be avoided. Long canes which might whip around in winter winds can be cut back about a third of their length. Some growers like to tie the canes into a bundle, others leave them free.

If manure is put on the beds it should be kept in the troughs between the hills; it should never touch the canes.



In wet or windy areas, mound of soil may tend to break down. Coarse screen or hardware cloth may be used to hold mound in place. Paper or other solid sheeting is not good because it does not permit free drainage.

Pine or spruce branches may be placed around the bushes to give protection against sunburn. They are a valuable supplement to hilling with soil, but not a substitute for hilling.

ROSE TYPES

How to recognize some of the more important classes of roses

Donald G. Huttleston

QUESTIONS such as, "But how do I know this is a Polyantha?" and "What is the difference between a Hybrid Perpetual and a Hybrid Tea?" are frequently asked around rose gardens. Answers such as, "See, it is called a Polyantha in the catalog," and "You just get to know as you learn roses," are unfortunately not rare. In view of the fact that many hybrid roses are derived from crosses between representatives of two or more different groups, such answers are understandable, but no less confusing to the questioner. Actually it is not easy, or in some instances, even possible to place a specific variety in a certain group. I shall attempt to characterize briefly some of the more popular groups, but the reader must be cautioned by the fact that the word "generally" should be appended to most of the characteristics.

Hybrid Tea rose SUN KING.

Roche

Bush Roses, with upright growth.

Hybrid Tea: To this group belong a great percentage of modern roses. The group arose from crosses between Tea roses and Hybrid Perpetuals, but in some cases other ancestry has been introduced. The flowers are large and produced singly or in groups of from 2 to 5. The buds are long-pointed and the foliage is somewhat rough and not lustrous.

Hybrid Perpetual: This is another, very popular group which, because it is an ancestor of Hybrid Teas, is notably difficult to separate from them. The bushes are tall and hardy with wrinkled, dull foliage and large, fragrant flowers which are never yellow. Flowers are borne singly or in groups of 2 to 5. Most varieties bloom only in June, but some are repeat bloomers.

Tea: This group contains the other ancestors of the Hybrid Teas. Be-

Pale pink Tea rose, MAMAN COCHET.

Courtesy W. Tillotson

cause of the fact that most varieties lack hardiness, they are cultivated extensively only in the South and West. The flowers, which vary from pastel pink to delicate yellow, are of medium size, fragrant, and borne in profusion through a long season.

Polyantha: These are sometimes called Baby Ramblers because of the small size of the bushes. The flowers are small and are borne in large clusters. They are hardy, continuous bloomers and the flowers are seldom fragrant.

Hybrid Perpetual rose, ROGER LAMBELIN, has fringed crimson petals marked with white.

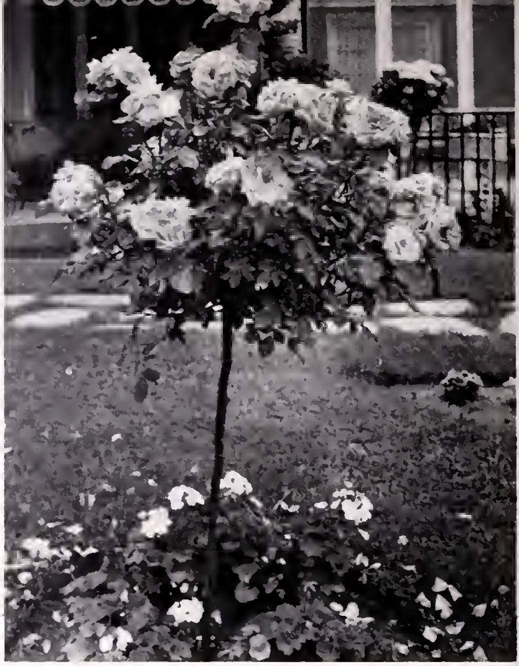
Roche

Polyantha rose, the salmon-pink CAMEO.

McFarland

Roche

Multicolored Floribunda rose, CIRCUS, current All-America Rose Selections award winner.



McFarland

Floribunda rose, FASHION, trained in tree form.

Rosa chinensis minima (*R. rouletti*), ancestor of many modern miniature roses.

McFarland

Hybrid Polyantha or Floribunda: These roses are derived from crosses of Polyanthas with Teas. The large flowers are borne in small clusters, and bloom continuously.

Tree or Standard: Hybrid Tea, Hybrid Perpetual, or Polyantha budded at the top of a stout, upright trunk thus giving the appearance of a dwarf tree. These are not sufficiently hardy without winter protection in the North but are suited for southern and western gardens.

Miniature or Fairy: A strain of tiny roses less than a foot in height which were derived from *Rosa chinensis*. The flowers, too, are very small, being less than an inch across.

Old-Fashioned: Straight wild species and also hybrid varieties used in old gardens. These include such groups as Moss, Damask, Sweet-briar and Rugosa.

A species rose, AUSTRIAN COPPER (*Rosa foetida bicolor*): petals scarlet within, yellow on outside.

McFarland

Moss rose. *Roche*

Roche

Rosy crimson MEG MERRILIES, a species hybrid of Sweet-briar (*Rosa eglanteria*). ↑

Mauve-pink Rugosa hybrid, DELICATA.

Courtesy W. Tillotson

McFarland

A single cluster of the crimson blossoms of the Rambler rose, ARCADIA.

Climbing Roses, with long, more or less lax canes.

Rambler: Dense clusters of small flowers borne on one-year-old wood. They were originally derived from *R. multiflora*.

Large-flowered Climber: Climbing roses with large flowers, more than 2 inches across, borne on wood that is 2 or more years old. Canes are larger and sturdier than those of Ramblers. In this group belong the following subgroups:

Pillar: Climbers of moderate growth which can be supported by a post.

Everblooming Climber: Large-flowered Climbers with more or less continuous bloom.

Trailer: With long, weak canes suitable for trailing over banks and walls.

Climbing Polyantha and Floribunda: Climbing roses that are similar to Polyanthas and Floribundas but do not bloom so continuously.

Climbing Hybrid Tea: these usually arise as sports from bush forms and are best suited for mild climates.

Costain

Large - flowered Climber, cameo-pink DR. W. VAN FLEET.

CONTEMPORARY ROSES

An evaluation of certain Hybrid Teas, Floribundas, and the new Grandifloras

George Ohlhus

I have been associated with roses ever since the time of my early boyhood in northern Germany, where I grew up in my father's rose nursery. For the past 25 years I have been in every phase of rose growing in this country and during this time have witnessed wonderful strides in the improvement of rose varieties—especially during the past 15 to 20 years. Nearly all the roses of 25 years ago have been replaced by new varieties and only a few old ones are still grown by nurserymen today and listed in their catalogs. Not only has the existing Hybrid Tea rose been improved, but new classes such as the Floribunda and the Grandiflora have been developed and introduced. These useful new types of roses have found their way into rose garden beds and borders everywhere, and are going to make possible a lot of new ideas in landscaping with roses.

Roche

An outstanding modern rose, the Hybrid Tea PEACE; Large-flowered Climber, CITY OF YORK in background.

Hybrid Tea Roses

The improvement in the Hybrid Tea class of rose consists generally of stronger plants and more disease-resistant and attractive foliage. The blooms have better form, are longer-lasting, and do not fade as much as old-time varieties. We have now a much wider range of colors and there is evidence of new colors still to come. The rigid testing that nearly all new roses undergo today at the hands of their originators and distributors undoubtedly points to the further improvement and development of new and better roses. They screen for adaptability, hardiness, disease resistance, vigor, and general worthwhileness and improvement over existing varieties.

The most popular class of rose today, in my judgment, is still the Hybrid Tea. It is most widely grown for garden purposes and cut flowers, and is excellent

HYBRID TEA ROSES

Variety	*Flower*	*Plant*	*Remarks*
PEACE	Buds yellow edged with pink; huge blossoms pastel yellow, pale gold, pearly white, apple-blossom pink	Superior, with dark green, holly-like leaves	One of the world's most successful roses
ECLIPSE	Yellow; buds long, pointed, well-formed	Vigorous, producing abundance of bloom	Good all-purpose yellow rose
LOWELL THOMAS	Double, very good form; bright, unfading canary-yellow	Bushy, upright, compact	
GRANDMERE JENNY	Pink and gold tinted	Bushy, vigorous; glossy, dark green foliage	New, outstanding for its constant blooming
SUTTER'S GOLD	Long, slender, well-shaped buds; golden shaded coppery-orange; fragrant	Long, straight stems; few thorns; glossy foliage	Excellent for cutting, color, and fragrance (especially noteworthy on cool fall days)
NOCTURNE	Long, pointed buds of good form open slowly to fragrant flowers of bright cardinal red	Vigorous, bushy plant with good foliage	One of the best of the newer deep reds
CHRYSLER IMPERIAL	Sparkling red, of exhibition form; very rich, strong fragrance	Excellent, with disease-resistant foliage	

for exhibition purposes. As a rule the buds are long and pointed. The flowers vary from single with one row of petals to very double with many rows of petals. Blooms are borne singly or not more than five to a cluster with long stems. Hybrid Tea roses bloom more or less continuously from early summer until freezing weather. The plants are fairly large and grow from 2 to 5 feet in height. One of the best varieties in this class is the ever-popular and distinguished rose PEACE, an All-America Rose Selection introduced by the Conard-Pyle Company. By every standard this is one of the world's greatest roses. Here we have a superior plant with beautiful, holly-like, dark green foliage. The well-formed, ovoid buds are golden-yellow edged with pink, opening slowly into huge flowers in delicate pastel tints of yellow, pale gold, pearly white, and apple-blossom pink which are delightful until the last petal drops.

HYBRID TEA ROSES

Variety	*Flower*	*Plant*	*Remarks*
CHARLOTTE ARMSTRONG	Long, slender, rose-red buds; extra large deep rose blossoms	Tall, vigorous, healthy	One of the most popular of all roses
PRESIDENT EISENHOWER	Well-formed, rich, unfading, rose-red	Good foliage and form	Brilliant and dependable, excellent for cutting and exhibition
HELEN TRAUBEL	Long tapering buds; large, open flowers, clear pink to luminous apricot	Tall, vigorous; foliage leathery	
DR. DEBAT	Large, long bud, rich pink with a salmon glow; blossom large, open, heavy-petalled, clear pink	Vigorous, upright; foliage dark	Seedling of RADIANCE
CONFIDENCE	Long, pointed, pink bud; large open flower with excellent form, soft pink blended with delicate yellow at bases of petals	Sound, upright plant	New growth comes fast, with many shoots producing a lot of rebloom quickly
TIFFANY	Long-lasting pink exhibition type on long stems; strong spicy fragrance	Excellent, tall and well-branched but compact	Newest pink

Roche

White Irene of Denmark, a Floribunda rose.

Floribundas

The second most popular class of rose variety is the fairly recently developed Floribunda. This class was derived by crossing Hybrid Tea roses with the Polyantha roses, more commonly called Baby Ramblers. The Floribundas also bloom more or less continuously throughout the growing season. The flowers are larger than the old type Polyantha roses but not as large as the Hybrid Teas. Flowers are born in clusters as in the Polyantha class, but there are not as many clusters and these are more widely spaced. The color range of these Floribundas is now almost as great as that of the Hybrid Teas. The first Floribundas had very little fragrance but in some of the newer varieties this also has been bred into these roses. This class of rose is excellent for mass planting; or as a border planting it will provide a splash of color

FLORIBUNDA ROSES

Bloom Throughout Season

Variety	*Flower*	*Plant*	*Remarks*
Red Favorite	Rich, dark, velvety red of outstanding lasting quality	Low, bushy	Recently introduced, very well adapted to edging borders
Fashion	Brilliant, luminous coral overlaid with gold	Vigorous, bushy	Very free bloomer, good for cutting; one of the most popular
Ma Perkins	Buds like those of Hybrid Teas, rich pink flushed yellow at base; flowers shell pink	Excellent	Good for cutting
Irene of Denmark	Exquisite form, usually pure white but occasionally tinged pink in cool weather	Vigorous, upright, foliage dark	Very free bloomer
Cocorico	Color the red of wild poppies	Tall, upright but bushy	Gay and showy

all through the season. The blooms can be used very effectively for table decoration, bouquets, and for exhibition arrangements. This class is steadily increasing in favor. Floribundas are generally hardier and more disease-resistant than Hybrid Teas, therefore they are easier for the average gardener to grow. Flowers are of excellent form and many varieties resemble the Hybrid Tea blooms but are smaller. The flowers on some of the newer varieties remain fresh and unfaded for days, either on the bush or as cut flowers (they are excellent for boutonnieres).

Grandifloras

The newest type of rose is the Grandiflora class. Only a very few varieties of this type have so far been produced. This class has been derived by crossing the Floribunda with the Hybrid Tea roses. It produces blooms in clusters as a Floribunda and also blooms singly on the same plant. The form approaches that of a Hybrid Tea even more so than a Floribunda does. This class, too, blooms continuously through the season. Grandifloras can be grown as shrubs if not pruned back. The color range is very limited so far, but we can soon expect the same colors as in our Hybrid Teas and Floribundas. Queen Elizabeth is a good example of this new type of rose, with its showy pink Hybrid Tea type blooms produced with the abundance of the Floribunda.

Hybridizers will continue to improve present popular rose types by breeding for better plants, disease-free foliage, and even longer-lasting flowers in nonfading colors. I believe we will very soon have hardy everblooming climbers in a range of colors, and with all the good qualities of a Hybrid Tea rose.

* * *

USEFUL BOOKS ON ROSES

American Rose Annuals 1916-1955. American Rose Society, 4048 Roselea Place, Columbus 19, Ohio. $4.50

Anyone Can Grow Roses, Cynthia Westcott. D. Van Nostrand Company, Inc., 250 Fourth Avenue, New York 3, N. Y. $2.50

Climbing Roses, Helen Van Pelt Wilson. M. Barrows and Company, Inc., 114 East 32nd Street, New York 16, N. Y. $3.95

Old Roses, E. E. Keays. The MacMillan Company, 60 Fifth Avenue, New York 11, N. Y. $3.00

The Book of the Rose, George M. Taylor. Winchester, Ltd., 16 Maddox Street, London, W 1, England. $3.00

Roses, Roy E. Shepherd. Rhinehart and Company, 232 Madison Avenue, New York, N. Y. $1.50

History of the Rose, Roy E. Shepherd. The MacMillan Company, 60 Fifth Avenue, New York 11, N. Y. $4.75

Roses for Every Garden, R. C. Allen. M. Barrows and Company, Inc., 114 East 32nd Street, New York 16, N. Y. $3.95

Mrs. Foote's Rose Book, Harriet R. Foote. Charles Branford Company, 551 Boylston Street, Boston 16, Massachusetts.

CLIMBING ROSES AS GARDEN ORNAMENTS

Which ones to grow and how to care for them

Stephen F. Hamblin

CLIMBING roses are less popular than bush roses for beds, as they require much space in which to grow, must have the support of an arbor or trellis, and require yearly training and pruning else they take over as a thorny jungle.

But there are compensations. One climber will give a wheelbarrow-load of flowers, equal to dozens of bush roses at their best crop. A two-dollar plant soon yields literally a hundredfold (not the first year). Bush roses in beds are usually pruned to heights of 4 to 6 feet, but climbers (many of them) may go to dizzy heights, and smother arbors and pergolas. The less robust climbers such as Pillar roses are better for small gardens. Planted on banks and slopes where pruning and training can be forgotten, they make billowy tangles of bloom. Originally the flowers of climbers were small, in clusters (the Ramblers) but now the Large-flowered Climbers, such as DR. W. VAN FLEET or BLAZE, give solitary or few-clustered blooms of the same size and form as the usual bush rose of the garden. Moreover, they are wholly suited for cutting. And some modern climbers give repeat bloom or autumn bloom to compete with Hybrid Teas in the rose garden.

For Cold Climates

Possibly the best way to list climbing roses is by hardiness and regional suitability. For our northern states, where winter hits zero or below, and frost penetrates the soil, there are the sister groups, the **Ramblers** and the **Large-flowered Climbers.** Both kinds are descended from

McFarland

Crimson Rambler rose, CHEVY CHASE.

the two tough wild climbers of Asia, *Rosa multiflora* and *R. wichuraiana* (our own *R. setigera* is also a parent); with *pollen* from various bush roses. So our hardy climbers have a hardy wild climber as one parent. Of the two groups which came forth, the Ramblers have rather small flowers (often double) in big clusters, and the Large-flowered Climbers have flowers of rose-garden size.

The **Ramblers** come in all the rose colors except yellow and bloom abundantly in June. Except for mass show they have lost popularity in favor of the larger flowers of their sister group. But one doesn't have to be content with old CRIMSON RAMBLER or DOROTHY PERKINS, for more than a hundred varieties are known, though not usually now offered by dealers. The ones suggested here are absolutely hardy to below-zero cold.

SUGGESTED RAMBLER ROSES

Bloom in Early Summer

CHEVY CHASE—deep red
EVANGELINE—rose
SWEETHEART—pink
GHISLAINE DE FÉLIGONDE—creamy white
SNOWDRIFT—pure white

The **Large-flowered Climbers** are now nearly endless in variety, but not all of them are at present offered by dealers. Some of them have inherited autumn-blooming character from the Tea parent. At least a dozen of the "repeaters" are now in gardens. Feed well and water in dry seasons to produce late summer buds.

McFarland

Musk rose (*Rosa moschata*).

For Warmer Climates

The **Musk rose** (*R. moschata*) is another wild climber from the warmer parts of Eurasia. Its hybrids, with clustered flowers, and some repeat bloom,

RECOMMENDED LARGE-FLOWERED CLIMBERS

Early Summer Bloomers

BLAZE—deep red
DR. HUEY—deep red
DR. W. VAN FLEET—pink
MARY WALLACE—pink
ELEGANCE—yellow
GOLDEN GLOW—yellow
SILVER MOON—white
BOBBINK WHITE CLIMBER—white

Repeat Bloomers

NEW DAWN—pink
DREAM GIRL—salmon-rose
CLIMBING GOLDILOCKS—yellow
WHITE DAWN—white

McFarland

Brilliant scarlet Large-flowered Climber, BLAZE.

are scarcely to be trusted to winters north of Long Island. Many are known as "Pemberton Ramblers." Their effect is the same as that of the hardy Ramblers, and they should be more frequently planted in regions where the ground is never frozen deeply. Such are—EVA, deep red; CLYTEMNESTRA, coppery pink; BELINDA, carmine pink; DAYBREAK, yellow; or PAX, pure white.

Noisette, an old group resulting from the union of Musk and Tea roses, is suited for regions having little frost. They are climbers with large, double, Tea-rose-like flowers. Little planted now, and rarely offered for regions where they will thrive, Noisettes have lost out in competition with the modern Climbing Hybrid Teas. But cherish such as LAMARQUE, light yellow; MARÉCHAL NIEL, deep yellow; or MILKMAID, soft white; they are now a practically lost group.

The high light of publicity now shines on the **Climbing Hybrid Tea roses**, which are not descended from a climbing hardy wild rose, but are robust sports or seedlings of the bush Hybrid Teas. While many of them may be grown (with winter care) in the warmer parts of our northern states, they bloom chiefly in June only, and if killed back severely by winter cold they give mostly only new growth with no flowers the following season. Unless the parentage is known (or a zero winter sets them back), they can scarcely be distinguished from the

CLIMBING HYBRID TEA ROSES

Bloom Chiefly in June

Dark red: SCORCHER, BLACK BOY, CLIMBING HADLEY
Rose: DR. J. H. NICOLAS, WAR PAINT, CLIMBING RADIANCE
Pink: MME. GREGOIRE STAECHLIN, ALOHA, CLIMBING DAINTY BESS
White: CLIMBING WHITE COLUMBIA, WHITE CLOUDS, CLIMBING WHITE KILLARNEY
Yellow: PAUL'S LEMON PILLAR, CLIMBING PEACE, CLIMBING SUNSET

true Large-flowered Climbers, and some dealers group the Climbing Hybrid Tea roses with the hardier Large-flowered Climbers. Of course, they are half-sisters by parentage. But in regions of mild winters (having some frost) the Climbing Hybrid Teas become truly robust climbers, as bulky as our SILVER MOON, with flowers like those of Hybrid Teas all season. From Virginia, south and westward, they will outgrow and out-produce the hardier Large-flowered Climbers. New sorts are coming out yearly, to the present total of more than 300, in all rose colors and forms.

In lands of no frost, where the orange grows, the Climbing Hybrid Tea rose is still the best climber. Where frost is rare, the Climbing Tea roses, climbing sports of the true bush Tea roses, are recommended. These once were popular where there is little winter (or in northern greenhouses), but their children, the Climbing Hybrid Teas, have nearly replaced them. In old gardens in California and Florida some Climbing Tea roses are still seen, and their sale should be revived for frostless regions. There they bloom the year around, resembling whole beds of Tea roses raised up vertically to tree form.

Roche

SILVER MOON.

CLIMBING TEA ROSES

Bloom Throughout Season

Red: LADY MARS
Rose: CLIMBING BRIDESMAID
Pink: CLIMBING CATHERINE MERMET
White: CLIMBING DEVONIENSIS
Yellow: GLOIRE DE DIJON

Three other tropical climbers are still in the race, though far behind Climbing Hybrid Teas in present popularity. Lady Banks rose (*Rosa banksiae*) is a high climber which has no thorns. The double white or yellow flowers are usually small and are borne in clusters in spring. The Macartney rose, a strong climber from China, has escaped from cultivation in Florida. Its 5 to 7 evergreen leaflets are nearly without teeth. The flowers are large, single, and white, appearing in late June, with some repeat bloom. Most favored is its Tea rose hybrid, MERMAID, with large, single, yellow flowers in summer. This rose is hardy (with covering) up to lands of winter frost. The Cherokee rose, another rose of Chinese origin, became an escape in Georgia in colonial days and is now the state emblem. It is a robust grower, the leaflets in threes and sharply toothed. The big wild-rose flowers are white or pink and double forms are now in our southern gardens.

Other types of climbers are known, but little seen today. The present emphasis is on the hardy Large-flowered Climbers, and the more tender Climbing Hybrid Teas.

PRUNING WITH PURPOSE

How to prune and train climbing roses

Helen Van Pelt Wilson

This article is a chapter from Mrs. Wilson's new book CLIMBING ROSES, published by M. Barrows and Co., Inc., New York, copyright 1955. It is used here by kind permission of the author and the publishers. Drawings by Léonie Bell.

CLIMBING roses as a group need little pruning. Only Rambler-types require much attention.

The first guide to pruning climbers lies in the nature of each plant: Does it naturally grow tall, that is to 20 or 30 feet, or is 7 to 8 feet a likely maximum? Does the variety in question set blooms on new or old wood, on the tips of upright canes or on horizontal growth; does it flower once or repeatedly right up to frost? Is its constitution tough or so tender that winter cold kills it back plenty and you value every bit of live wood in spring?

The second, less important guide lies in the destiny you offer each plant: What do you want it to do? Do you wish it to stay neat and tidy as adornment for pillar or delicate arch, or do you expect it to cover the side of your house or spread out all over a low roof so you can look down on it from upstairs windows? Or are you in hopes it will clamber far over a great rocky outcropping or along a monstrously-long fence? If you plant climbers with growth habits suited to their locations, you will have much less pruning to do than if you try to make varieties of naturally-vigorous constitution play restricted roles.

After the main season of flowering is over—and the only one for Ramblers and once-bloomers—you can attend to any really important pruning you have in mind. As far as health is concerned, however, you can leave most of the climbers alone, unless you have in view special destinies for them. After first flowering, then, is the time to prune—and train—as you see fit.

Suckers

Sucker growth from the base of plants may be hard to identify unless the bud-union is well above ground. It is, of course, growth that emerges from the root-stock on which the choicer climbing variety has been budded. The stock was selected in the first place for its vigor. Sometimes it tries to take over. If allowed to flourish, that's just what it will do, destroying the desirable top by crowding it out.

If an unusually strong cane appears at the base of your climbing rose, examine it. It can look somewhat different, especially in color, and still belong, since the young growth of many plants often differs from the old. Usually, however, color and texture of foliage and type of thorns and shoots from the understock are very different. If you aren't sure, first try to determine the source of growth. Suckers start from a point *below* the bud or knob of the union. Suckers from Multiflora understock, the one most commonly used, have light-green foliage and clusters of white flowers, if they get that far. RAGGED ROBIN understock, which is considerably used in California, has reddish leaves and a red flower. If you are sure basal growth is from the understock, cut it *out*, not simply *off*, or it will soon get going again. If necessary, scrape away a little soil so as to remove suckers at the point from which they start.

Seven-leaflet leaves are rarely indications of sucker growth. Most climbers produce canes with such leaflets. If you remove all such growth, you may be destroying your plant's future. *Point of incidence is the best guide to identification of suckers*—and, of course, knowledge of the type plant used for understock.

Tools You Need

By all means get proper tools and keep them sharp. (I store mine in a *private* place where there's no chance of having them borrowed to whack off the forsythias or other shrubs and so ruin the good spring and sharp edge I need for my roses.) Snapcut pruners are all right for removing faded roses and young or not too heavy growth, but you need first-quality curve-edged pruners for heavy rose canes. Get as large a pair as you can handle comfortably, and keep the edge keen. Remember to get them professionally sharpened before the season of use is upon you and the man who sharpens is inundated with work. If you have a lot of climbers to tend, pruners may have to have a second sharpening later in the season.

Dull pruning shears are a menace. They tear canes and leave jagged cuts which do not heal quickly. The long-exposed pith invites borers and is prone to disease. Dull pruners are also revolting to use. They would try the patience of a saint. But I love pruning with nice sharp shears. Indeed so delightful is the occupation that many an enthusiast is tempted to overdo, especially the men. The power of pruning goes to their heads. After practically cutting a climber to the ground, they will maintain that hard pruning invigorates plants. Actually many of us used to believe that.

Now we realize that hard pruning reduces leafage, and leaves are the manufacturers of food. Plants need them.

If you have old, very woody climbers, you may also need a small saw. Canes often prove too heavy for your hand pruners and, if you twist these, to make them cut through tough growth, you'll ruin them—for good. Lopping shears are also essential if a big arch or arbor must be kept trimmed. You could wear out your arm tending it just with pruning shears.

And do get yourself some heavy leather gauntlets with a good cuff, if you have much pruning to attend to, as with Ramblers, and wear long sleeves, too. I have known some who tried it in shorts and sports shirt with dire results. Pruning should not be akin to martyrdom; it's really fun!

Early Spring Pruning

With these two guides—the nature of each plant and your purpose concerning it—first prune each climber, *if it needs it*, very lightly in early spring. *Wait for main pruning until after blooming.* Cutting before, if extensive, removes wood that produces flower buds.

The *time* for the first light pruning depends on locality. Cut very sparingly when you see leaf buds swelling and preferably before the leaves unfold. This could be late January or early February along the Gulf or in California, a few weeks later in Georgia and the Upper South, around April first in New Jersey, Pennsylvania, and the Midwest, and about the fifteenth in New England and Canada. In some sections of Florida it could even be in December. The date of spring growth varies, of course, with seasons. Also there's nothing dangerous about a little leeway. You *can* prune after leaves open.

The purpose of the early spring pruning is simply to remove wood damaged by weather or disease. Cut back to sound tissue any canes with cankers; cut back to the ground line, if necessary, any dead canes; cut well below any splits in bark which occur when a long branch has been torn away from a main stem by the wind; cut away weak, twiggy growth that thickens up the center of a plant: it has no future. On the whole, *go easy this first time.* You can always do a little supplementary pruning, as you see the full extent of winter damage, if that tends to be considerable in your locality.

If you aren't sure about the true condition of a cane, wait a little and watch behavior. Generally, damaged wood is darker than normal for a variety, but sound old wood may also be dark colored. In spring most healthy wood is rather light green or yellowish. Healthy pith is normally white; if it is brown, keep cutting back till you reach a section with white pith.

When you cut across a cane that is larger, say, than a lead pencil, it is wise to protect the cut area. (Some climbers, especially the yellows of foetida parentage, will positively die if *every* wound is not covered.) Expose as little pith as possible, of course, by making only *slightly* slanting cuts. Then smear these with tree paint—an asphalt compound is best—or shellac or, if there are only a few cut canes to protect, cover each with a little wad of chewing gum.

If you must, also prune now a little for shapeliness, but operate with a light hand. Keep in mind, *when you prune away sound growth in spring, you are removing flowering wood.* Can your climbers spare it and do you wish to reduce the crop for the sake of conformity perhaps to arch or fence rail? Often such regulation of growth is well worth while for the overall looks of a plant, but generally you should wait until after first flowering. My point is, when you prune, know what you are doing—and why.

How to Prune

When you prune, always cut back close to a leaf bud. Don't slice into it, and don't cut so far above it you leave a piece of stem to rot, as when a cut is made halfway between buds. Try to cut about a quarter-inch above. Let the cut point outward if you want to develop open, fanwise growth. Slant the cut in if there's an open space that needs a new cane to fill it. But don't be too concerned about this; you can always *train* new growth if it doesn't start in the right direction.

Pruning the Ramblers

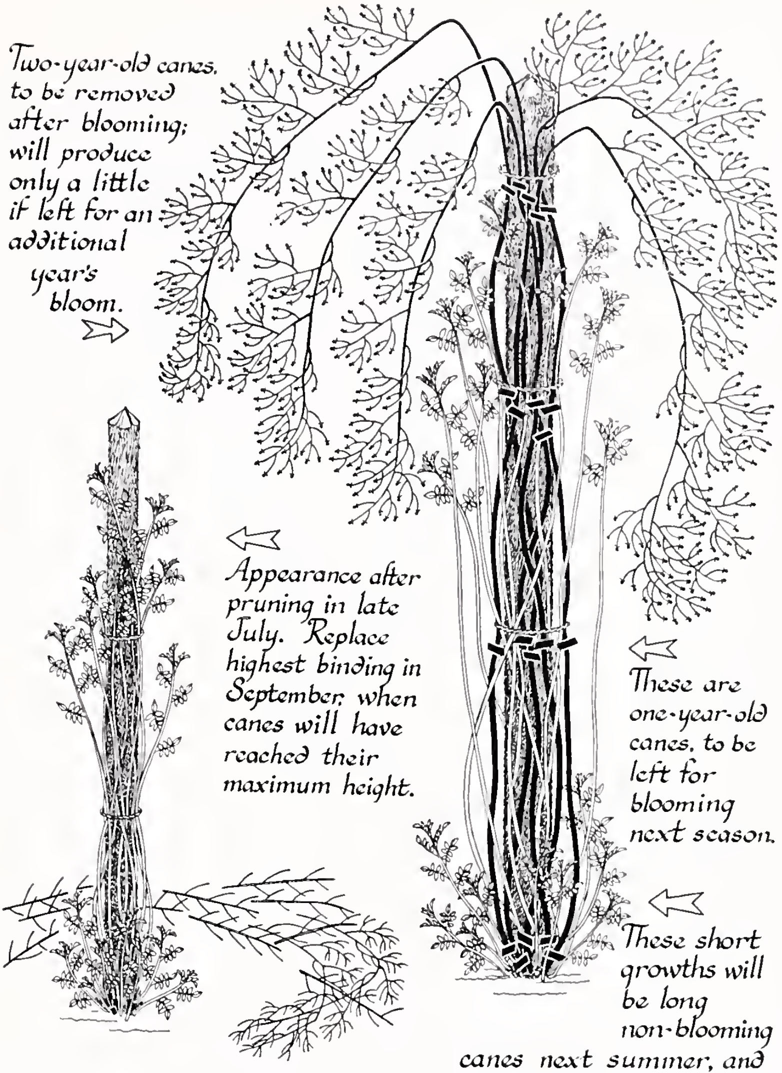
The old-fashioned, cluster-flowered Ramblers, with individual blossoms usually under 2 inches, often produce 15 to 20 feet of pliable canes in one season. Typical of this group are the pink DOROTHY PERKINS, red CHEVY CHASE, and SANDERS' WHITE RAMBLER. These need more pruning than the Large-flowered Climbers.

Ramblers produce best on year-old wood, so this year's choice blooms come on last year's growth. And one year's growth can be prodigious! Unless space is no object and a plant can spread tremendously, as over a low roof on a Nantucket cottage or an outcropping of New England boulders, a Rambler needs severe cutting back fairly regularly.

Soon after a Rambler blooms, you will notice that a considerable number of strong new shoots are under way at the base—already 3 feet long perhaps. The recommended practice is to remove Ramblers yearly from their supports, lay them on the ground, and cut out all the old canes right at the ground line. Then tie up the new canes as in the drawing. But what a job!

Actually, if you cut out *some* of the old *canes* (which also bear a small amount of flowers), every year, or *all* of the old ones every second or third year, depending on available space and thickness of growth, you will still be able to keep your Ramblers from turning into thorny thickets, as they too often do. The remedy for this condition, of course, is to chop down the plants completely and let them start all over again. You can't separate new canes from old at the thicket stage, so better not let Ramblers reach it.

When you do remove old canes, deal with them piecemeal. Instead of making but one cut at the ground line and pulling out each enormous cane all in one piece—which, suddenly released, can practically knock you flat—cut across the canes you are removing every 8 inches or so. Most of the small pieces will then fall out, and



Two-year-old canes, to be removed after blooming; will produce only a little if left for an additional year's bloom.

Appearance after pruning in late July. Replace highest binding in September, when canes will have reached their maximum height.

These are one-year-old canes, to be left for blooming next season.

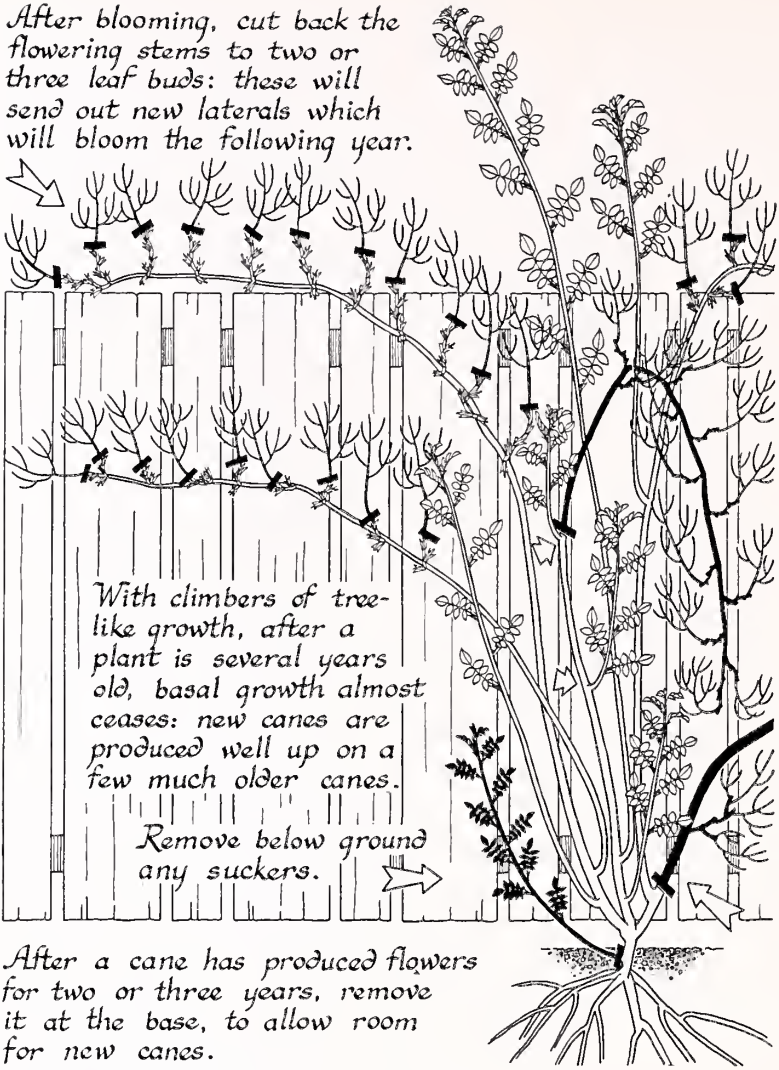
These short growths will be long non-blooming canes next summer, and will bloom the following summer, their third season.

VIII How to Prune Ramblers

you can easily pull out the sticklers by catching hold of them with your pruners. Raking up the pieces is simple compared to all-in-one removal of a giant cane.

Pruning Once-blooming Large-flowered Types

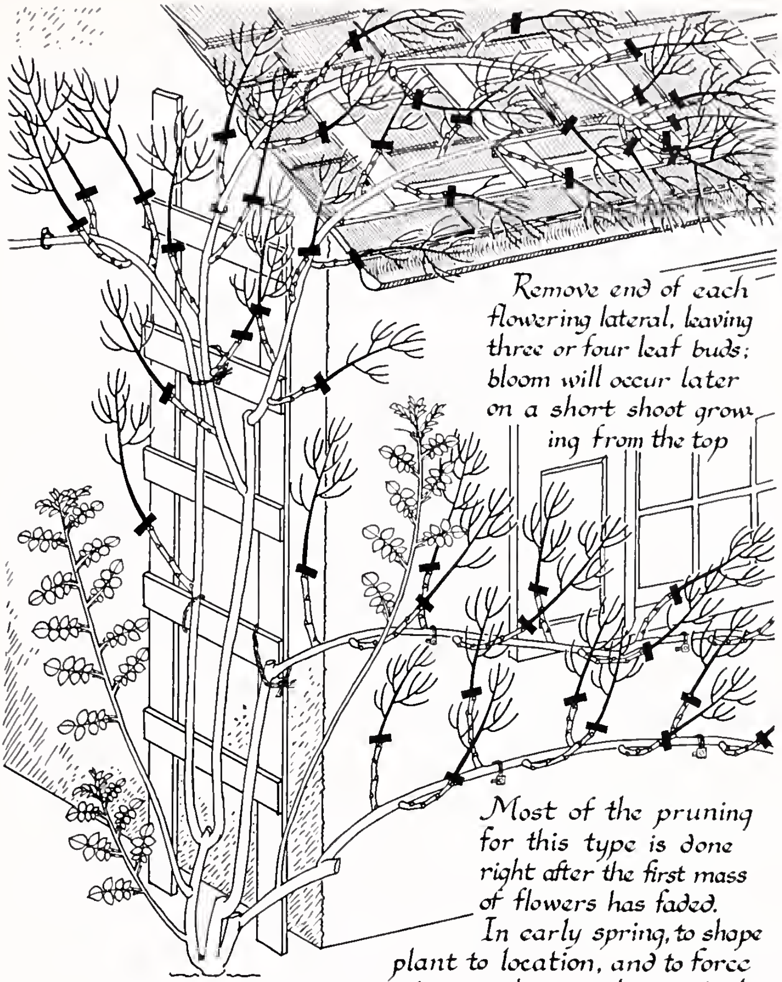
Don't let pruning prey on your mind. Too often conscientious, but inexperienced, gardeners read in the newspaper garden pages and periodicals the usual June counsel to prune climbing roses. This is timely advice but like all generalities, it must be interpreted in terms of *your* roses. And maybe yours need very little pruning, especially if they are quite young or very old. Canes of the Large-flowered Climbers are not so pliable as those on Ramblers, and as plants mature, fewer new canes spring up from the base.


After blooming, cut back the flowering stems to two or three leaf buds: these will send out new laterals which will bloom the following year.
With climbers of tree-like growth, after a plant is several years old, basal growth almost ceases: new canes are produced well up on a few much older canes.
Remove below ground any suckers.
After a cane has produced flowers for two or three years, remove it at the base, to allow room for new canes.

x-How to Prune Once-blooming Large-flowered Climbers

Typical of this class are the red Bess Lovett, Dr. Huey, Paul's Scarlet Climber, and Thor; the pink Dr. W. Van Fleet, Mary Wallace, and Mme. Gregoire Staechlin; the white City of York and Silver Moon; and the yellow Doubloons, Elegance, and Golden Climber.

If any of these are grown for a neat, definite pattern, as on a long fence or perhaps espaliered against a house, after first bloom is over they may require considerable pruning. The amount depends, as always, on chosen manner of growth, and space. Usually there is side growth that needs to be cut off in order to keep plants flat where *you* want them so.



Remove end of each flowering lateral, leaving three or four leaf buds; bloom will occur later on a short shoot growing from the top

Most of the pruning for this type is done right after the first mass of flowers has faded. In early spring, to shape plant to location, and to force side growth, some heading back of canes should be done. Use the lopping shears for high spots.

XI – How to Prune Repeat-blooming Large-flowered Climbers

On most once-bloomers, prune all you feel like right after flowering and repeat the job if it should be required through the summer. *This year's flowers will usually be produced on the side shoots or laterals that grow out from the old wood.* After flowering, cut these back to 5 to 15 inches. Let them stay long and train them if you want a *broad* display.

When plants of the large-flowering once-bloomers are well established, but not before, it will be time enough to consider taking out perhaps a third of the oldest canes at the base, or maybe just one of them. Since many choice climbers in this class hardly come into their own before the third year after planting, don't consider removing canes until then—and maybe not till the fifth year.

Before you do so, ask yourself, has my SILVER MOON, DR. W. VAN FLEET, or PAUL'S SCARLET (1) grown out of bounds, or (2) are some of the canes not producing well? A yes-answer to either would indicate some cane-removal at the base, particularly if the plant was long-established and there were rather dark, woody-looking canes that bore sparsely. Always keep in mind *you prune mainly to keep plants sufficiently renewed for good flower production.* Types vary in the production quality of old and new wood.

Some once-bloomers like GOLDEN CLIMBER (MRS. ARTHUR CURTISS JAMES) and SILVER MOON produce treelike growth which should make an enthusiastic pruner go easy. On these there is much less new basal growth than on Ramblers, for instance, and flowers are freely produced from old wood.

The thing we all have to do is to know our own particular climbers. I repeat: Many take at least three years to become established. In the case of GOLDEN CLIMBER, just mentioned, that is certainly so. Also its flowers come not on laterals but on stems from these, that is, on sub-laterals. Too often there is disappointment with this truly handsome climber because people get impatient with it, train it straight up, not sidewise as it requires, and prune it much too drastically.

I cut very little from my now five-year plant except to keep it from growing across a window. I've allotted to it half the front of the house and am encouraging it to spread over the little portico of the front door too. After canes are trained up, they are leveled off so as to develop many sub-laterals open to sun and air. Even some of the faded blossoms are left so handsome seed hips can develop for autumn display.

If you want neater plants in the after-bloom weeks, cut back the flower clusters (of once-bloomers) to 4 to 6 inches. But don't do that on the repeat climbers we are going to talk about next, or you will destroy lots of developing flower buds.

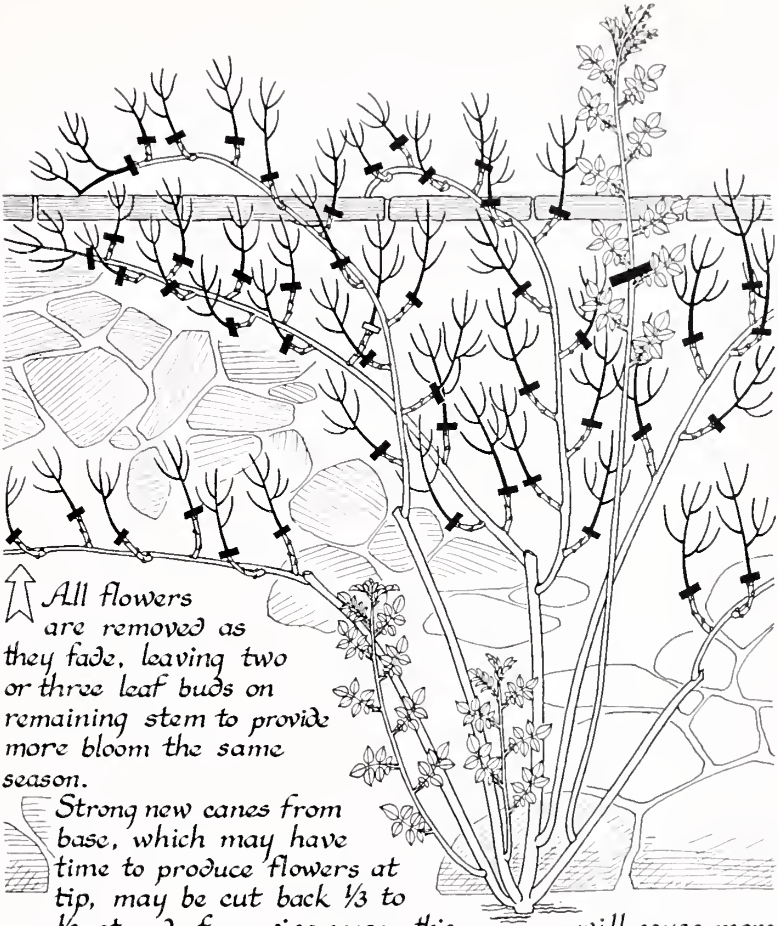
Pruning Repeat or Everblooming Climbers

Some climbers bloom off and on during the summer and then heavily in the fall. They are the repeaters, a variable group on production. Among them are the red BLAZE (the newest strain much more productive than the old), the pink DR. J. H. NICOLAS, DREAM GIRL, INSPIRATION, PARADE, and NEW DAWN; the yellow MERMAID and MRS. WHITMAN CROSS; and the white PROSPERITY.

The Climbing Hybrid Teas, like CRIMSON GLORY and PAUL'S LEMON PILLAR, and the Climbing Polyanthas, like SUMMER SNOW and GOLDILOCKS, bloom fairly steadily. The group known as Brownell's Everblooming Pillars are very constant, producing amazing amounts of flowers on every tip of growth, and these set no blind canes. Prune only to keep plants shapely and ornamental in the place allotted to them.

If you grow any of these repeat or constant climbers, remember *most of them shudder at the sight of pruning shears.* Their balance between vegetative and flowering growth is naturally delicate. Futhermore, many of them (though not the Brownell group) are more winter-tender than the once-bloomers, so some growth will usually be winterkilled. Cut that back to live wood at the time of early spring pruning; prune in summer only to keep plants shapely and to remove faded flowers. Unless, of course, you are trying to keep to pillar-size varieties like NEW DAWN or JACOTTE which then must be headed back two or three times a season.

Cut off dead blooms with very *short* stems. The next crop of roses comes out of the axil of the first normal leaf just below the fading flower cluster. Cut just a quarter-inch above this. Get rid of withered flowers well before they start turning into seed pods, and preferably before they shatter and petals fall.



All flowers are removed as they fade, leaving two or three leaf buds on remaining stem to provide more bloom the same season.

Strong new canes from base, which may have time to produce flowers at tip, may be cut back ⅓ to ½ at end of growing season: this will cause more and longer blooming laterals to develop the following season.

Less vigorous varieties trained on pillars need only winter-killed tips removed in early spring. faded blossoms later.

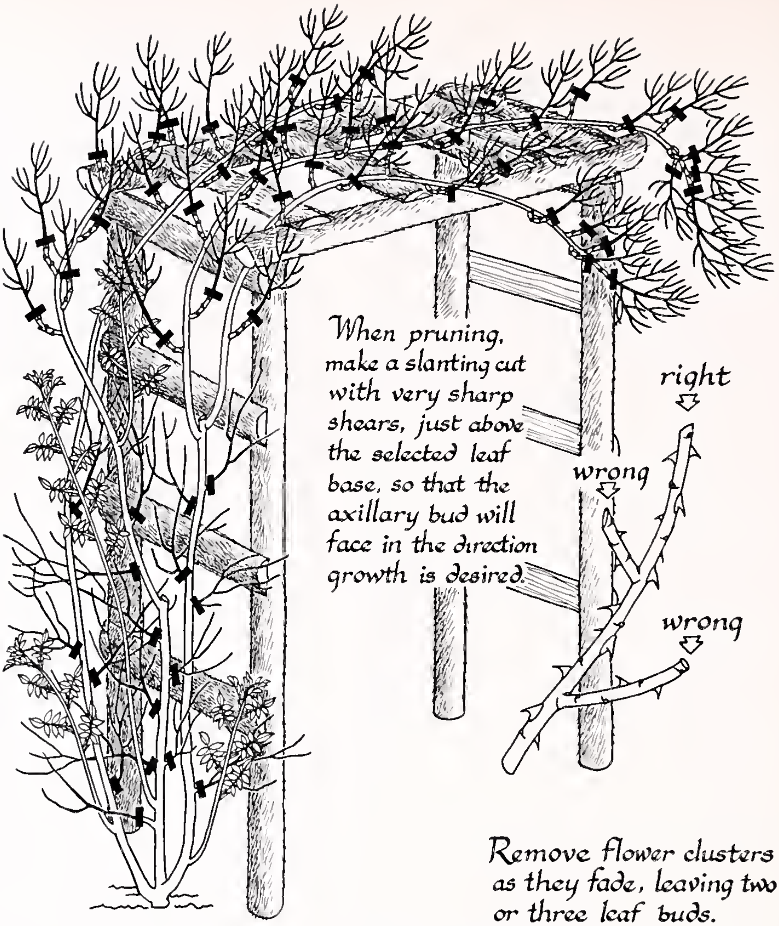
XIV-How to Prune Climbing Hybrid Teas

Pruning Shrubs or Could-be Climbers and the Trailers

Little pruning is necessary for any of these except as you wish to shape them to your purpose along a fence, to thin them for productive growth, which will necessitate some removal of canes (perhaps a fourth of them each year) on older plants, and, of course, removal of any winterkilled wood, which won't be much.

Trailing roses like CARPET OF GOLD, MAX GRAF, CORAL CREEPER, and *Rosa wichuraiana* itself require almost nothing: a little thinning perhaps and removal of any dead branches.

By no means remove faded flowers from shrubs or trailers. There is a handsome crop of black, scarlet, or orange hips possible from all of them, lovely for autumn and Christmas decoration. Let these develop for a second glory.



When pruning, make a slanting cut with very sharp shears, just above the selected leaf base, so that the axillary bud will face in the direction growth is desired.

Remove flower clusters as they fade, leaving two or three leaf buds.

Remove older canes where necessary, to avoid overcrowding. Keep canes clear of brush and spindly growth which the Climbing Floribundas tend to produce.

XVI - How to Prune Climbing Floribundas

How to Cut Flowers for the House

While climbers are small, control your urge to cut roses for bouquets and arrangements. At first, plants need all possible vegetative growth. Most of them have a long way to grow; they need all the leaves they produce if their efforts at tall growing are to be properly nourished. Therefore cut roses on young plants no further back than the first normal leaflets. With the short-stemmed roses you can make floating arrangements, using foliage from other plants. Even when Climbing Hybrid Teas and Climbing Floribundas are well developed, be sparing with stem-cutting; long stems mean fewer flowers so you must make a choice.

Well-grown Ramblers and other once-bloomers you can, of course, cut by the armful, and what a joy that will be. Great blue jars of NEW DAWN, green baskets of PAUL'S SCARLET and white CITY OF

YORK, an urn of yellow ELEGANCE—these are lovely dividends from climbing roses.

Controls for Climbers

The placement of the canes of climbers is one of the important—and pleasurable—aspects of their culture. I like to develop patterns according to where plants are growing, and so training goes on more or less throughout the season. When growth is soft and pliable in early summer, you can work most easily, but if your climbers are tall, vigorous types, you will be on a ladder later, too, with hammer and wall nails or ordinary nails and raffia in hand as you deploy the stiff canes where you wish them to go. Lacking the adjuncts of the true climber, as I have said, the so-called *climbing* rose is always at your mercy. Without the support *you* provide, and the guidance, it is likely only to cover the ground, or on occasion to affiliate itself with a tall tree having low approachable growth on which to start an ascent.

Means of Tying

There are several ways to hold canes to supports but the U-shaped staple is not among them. No matter how large a size you start with, the staple eventually binds and stunts growth. My favorite "holder" is the Francis Wall Nail with a soft lead prong about an inch long. You can bend this tightly around a cane or just angle it as a support; also, as the cane grows, you can pull this wall nail out quite easily and fasten it higher up. This is an advantage, since it is not an inexpensive gadget and furthermore it does rust. Even so, for fastening a climbing rose directly against a house (which I do as know I shouldn't!), this wall nail is my pet. Ordinary nails with a small loop of twine fastened around the head and a bigger loop around the cane work well, too.

Whenever a cane is fastened, it is wise to do the tying first—to pole, rail, or whatever—and then the loose looping around the cane. There should always be sufficient leeway for a cane to move a little. A binding tie will bruise and even cut.

Generally used for tying canes are jute, raffia, narrow strips of cloth, and I also like a paper-bound wire called Twist-X-Tye. It comes on a great cardboard spool and is easily cut by clippers without ruining the edge. I use this bound wire for fastening canes around upright fence posts or drawing canes fanwise or horizontally to the rails and holding them there while growth is too short to reach. For trellis-growers this wire is useful, too.

Methods of Training

In training climbers it is, as I have said, important to know the nature of each one. Unless varieties are designated as Pillars and are capable of bloom on tall upright growth, you will be very disappointed in their performance if you so train them. The Climbing Hybrid Teas and Climbing Floribundas do well on pillars, so do BLAZE, DR. J. H. NICOLAS, PINK CLOUD, PARADE, and many more. But many climbers bloom better if the greater part of the growth is placed horizontally. It is possible, of course, even with GOLDEN CLIMBER, to take canes straight up to a first floor roof, say, and *then* spread them out; only so will the plant really bloom, and how magnificently!

When you want a neat job, almost an espalier—as I prefer all vines—train and attach canes on the *outside* of the plant to the *lowest* part of the trellis, or run them a little way along the foundation of the house. Then fasten the inner canes higher up so that they travel vertically a short distance before they assume the side- or fan-wise line. Actually you can develop quite an exact horizontal pattern on a post-and-rail or post-and-board fence if you have the patience—and enjoy the task as I do. And how those horizontal canes bloom, especially on shrub roses grown as climbers, and INSPIRATION along a fence produces 15- to 18-inch stems.

Once a tall-growing plant is well established, unless space is unlimited, you cannot *train* all the vigorous canes it produces at the base (these are rarely suckers), so you will discover that training-plus-pruning tends to be a delightful summer-long occupation.

A NEW RACE OF ROSES

How to hybridize, and how hybridization and selection have given rise to a strain of roses having sub-zero hardiness, resistance to disease, and beauty of bush and bloom

Walter D. Brownell

"WHAT makes a rose?"

First and foremost it is the garden that makes a rose. It is through the garden that gladness comes to the heart of the rose lover. This may well have been the thought in the minds of Mrs. Cranford and her late husband 26 years ago when they made possible the Cranford Memorial Rose Garden at the Brooklyn Botanic Garden, that has since gladdened the hearts of millions of visitors.

A learned writer has said that a rose by any other name would smell as sweet. But would the rose in any other *form* bring as much joy to those many gardeners who love flowers?

The admiration for the rose, as you know, extends back for thousands of years. Until a century or so ago, its form had not changed very much. There were then only wild (species) roses because hybridizing, or cross breeding, had not begun. When hybridizing did begin, it was believed by some that this process carried something new and magical.

Hybridizing

It is now well known that the factors in the constitution of plants, called genes (character determiners), crossed with those of another, produce only a recombination of the characters of the two parents. And yet, we marvel at the greater beauty of modern rose blossoms as compared with the flowers of species roses—the ancestors of all modern roses. The hybridizer, by pollinating one variety with another, merely sets the stage. He can add nothing.

Nature performs the miracle of reproduction. That miracle combines some of the characteristics of one parent with some of those of the other to form seedlings of the next generation.

Among the marvels of nature's miracles, there is more that can happen. At infrequent intervals changes of character may suddenly take place even though no crossing has been performed. Such variations are called mutations or sports.

Thus species roses grew in the wild practically unchanged, as to man's purposes, for thousands of years. Then man with the pollen brush and by selection from nature's variations, greatly speeded up the process by which good new varieties arise. There are now several thousand varieties of roses that may appeal to the whims and tastes of every fancier.

Whom have we to thank for having thus attained the lofty heights of the Queen of Flowers? There are hundreds who have labored to this end—the rose hybridizers of America and of the world. They are too numerous to mention here, but all have helped to mold the beauty and the fragrance of modern roses.

I would like to tell you a little about the work of the Brownells of Little Compton, Rhode Island (of whom you have probably never heard); old in years, young in their hearts, and eager in their minds to continue toward their ideals and add a little to garden rose betterment.

Author photo

Mr. and Mrs. Walter Brownell in their experimental rose garden at Little Compton, Rhode Island.

Beginnings

Soon after our wedding we started a small rose garden. We were both fond of roses, and the rose catalogs told us how easy it was to have beautiful blooms all summer long. We expected it. We tried it. *We failed.* The plants developed black spot; the leaves fell off in the summer; the bushes died in the winter. The question that came into our minds was not how to produce more beautiful roses—they were indeed beautiful—but why were not the bushes more sturdy?

What they needed, it seemed to us, was greater vigor, longer life and the ability to survive cold winters, and freedom from black spot. They should also have more cumulative growth, like plants in the wild, and more constant blooms in greater abundance.

Can you imagine a young couple starting a hybridizing project with all those objectives? Little did we know what we were then undertaking—we can be excused only on the ground of ignorance.

There was a virgin field ahead. Several leading scientists became interested and were eager to cooperate.

Finding the Parents

As I indicated in the beginning, it has been shown that all plant betterment must come from recombining the characters of parent plants or through mutation or variation in nature. We therefore devoted the first 10 years to study and inspection, to determine the most appropriate material for the basis of the operations. The garden roses then in existence did not possess the necessary requirements. It therefore seemed advisable to select some species rose that would, through hybridizing, fortify the Hybrid Teas and lift them up to meet nature's requirements in the wild.

There was no reason why this should not have been done before, except that much labor with great expense was necessary to breed successfully at the same time for plant sturdiness and a beautiful Hybrid Tea flower.

Rosa wichuraiana, which most of us know as the Memorial rose, was chosen for its vigor and resistance to cold and disease. Since it is a low-growing or creeping vine with a large cluster of small white flowers, blooming only once in the spring, it needs must be a long route to the swapping of characters to combine the beauty of large Hybrid Tea blooms and upright bush characters with the sturdiness, vigor, and resistance to cold and disease of the species. The Memorial rose resists cold to about 15°F. below zero, and it is nonsusceptible to black spot.

These characters had already been transmitted to descendants known as the class of Large-flowered Climbers which bloom only once each season. Familiar examples are MARY WALLACE and DR. W. VAN FLEET.

It soon became evident through tests that winter resistance could be bred into Hybrid Tea roses, but the problem of getting seedlings nonsusceptible to black spot was most discouraging. You may be surprised to learn that today, after millions of crosses made over a period of more than 40 years, we have but nine Sub-zero Hybrid Tea varieties that have inherited from *Rosa wichuraiana* its complete nonsusceptibility to black spot, and only one of these has yellow flowers. But many of the others produced are much less susceptible than most roses, and the research has progressed so far that you may be assured that in the decades to come there will be no reason to grow roses that defoliate from black spot.

How Crosses Are Made

Perhaps some of you would like to know how the process for extensive hybridizing or cross breeding is carried on. With us, it begins at rose time, during college and high school vacation. Assembled in the field are perhaps a dozen girls interested in genetics, botany, biology, and the like. Each is equipped with small scisors, glassine bags, tiny rubber bands, and narrow strips of aluminum inscribed with a number to identify the selected pollen of the male parent.

About 2 days before the petals of the seed parent flowers open they are removed and the anthers snipped off so the flower will not be self-pollinated. Then the seed parent is covered with a bag to protect it against unwanted pollen. The rubber band promptly applied holds the bag in place. Two days later, when the pistil is sticky and receptive, the selected pollen gathered 2 or 3 days before is applied with a small brush, and the bag replaced. The aluminum tag is wound just below the bag.

That is all there is to it except to add that these girls are really interested; for what else could hold them in the hot sun all day long, under broad-brimmed hats, doing that same thing over and over again; and a nearby beach cooled by breezes and refreshing surf. But—no swim for them, only that same thing day after day, each girl making five hundred crosses daily before she goes home.

The seeds ripen by Thanksgiving time and are planted in flats in the greenhouse before Christmas. They germinate in the late winter and early spring, to be planted out in a field as soon as the frosts are over. There are about 2 acres of them totaling annually some 20,000 plants, in rows that placed end-to-end would extend 3 miles in length. They have to be scouted during the summer nearly every day for selections to be tested during the next 3 years, for introduction, or to be destroyed. On the average, only one acceptable variety is found in that annual lot of 20,000.

Seedlings change during their early life, much as children do. Some look promising at first, later to be disappointing; others that are scarcely noticed the first year become very interesting later. It is usually 7 years from the pollination of the parents of a new variety to its introduction.

Thus it is that we have been able to breed roses as large and beautiful as any, all *Rosa wichuraiana* hybrids, in the classes of Hybrid Teas and hardy once-blooming climbers, that can take 15° below zero without protection.

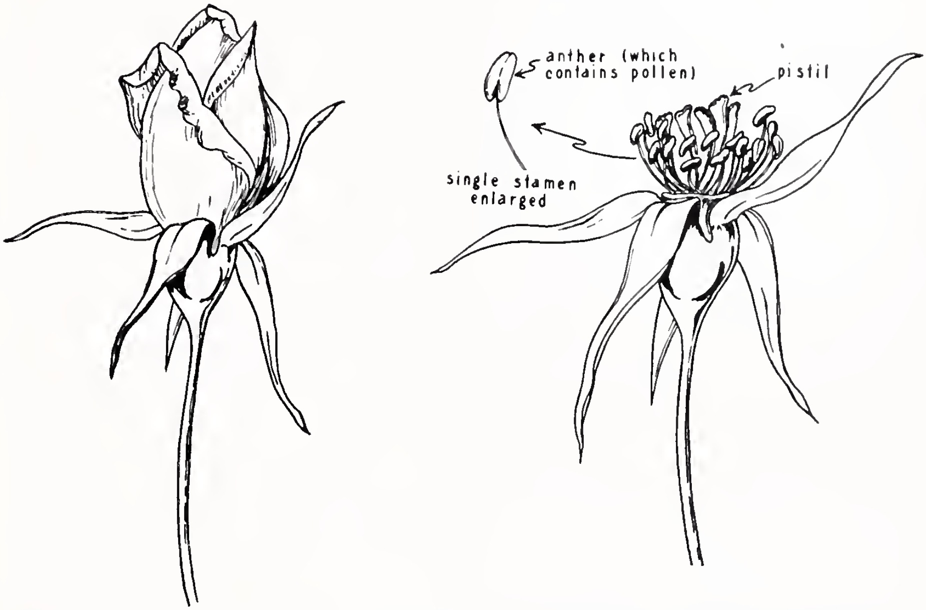
Another Development

Another thing has happened at the gardens in Little Compton — something quite new and different, something sought for a century by rose breeders, something of interest to all rosarians.

Today there are growing throughout the country in rose beds Hybrid Teas and Floribundas, bushes of moderate height that bloom more or less throughout the growing season. Then there are Climbers and Pillars that cover trellises and the like, that bloom only in spring—and the latter do not bloom the first year planted. There are still other Climbers that have limited reblooming habit.

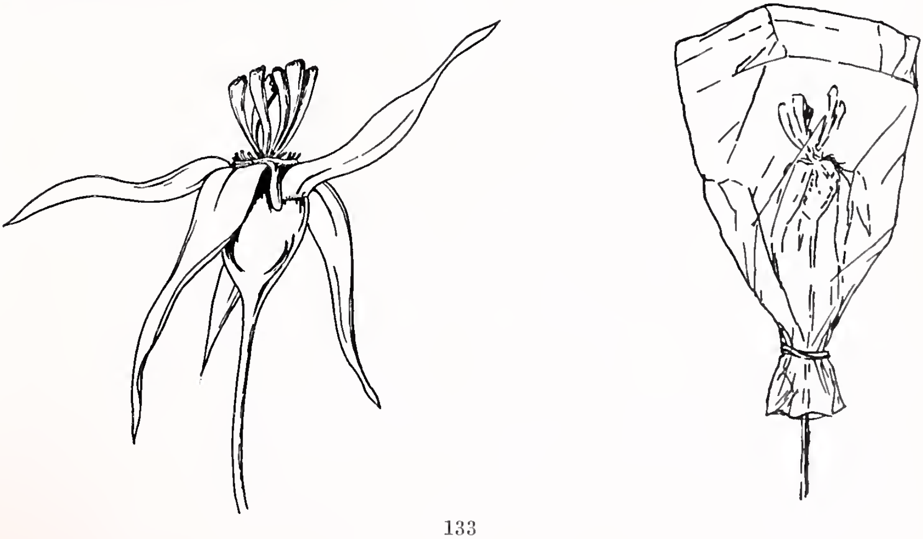
The Technique of Hybridizing

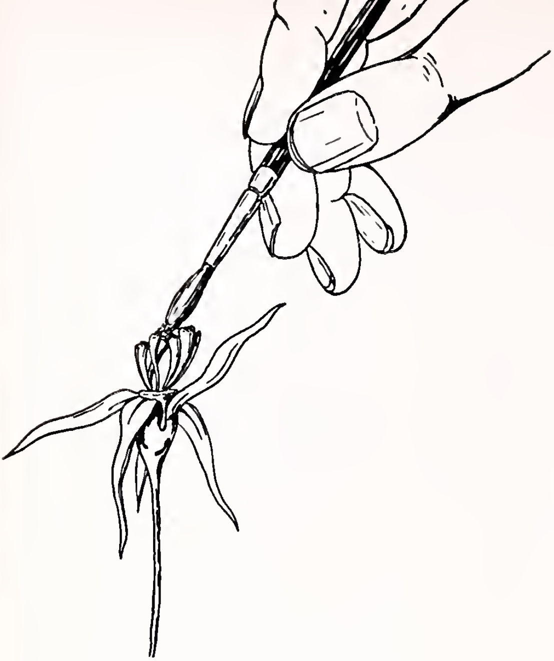
Hybridizing on a large scale as commercial rose growers do it is fascinating work, but is *work* nevertheless. The amateur can enjoy the satisfaction of hybridizing with practically no work at all. These diagrams, and Mr. Brownell's description on the page opposite explain how it is done.



Left, bud of female (seed) parent about 2 days before it opens. At this stage petals should be removed leaving flower as at right, showing stamens (male) and pistils (female).

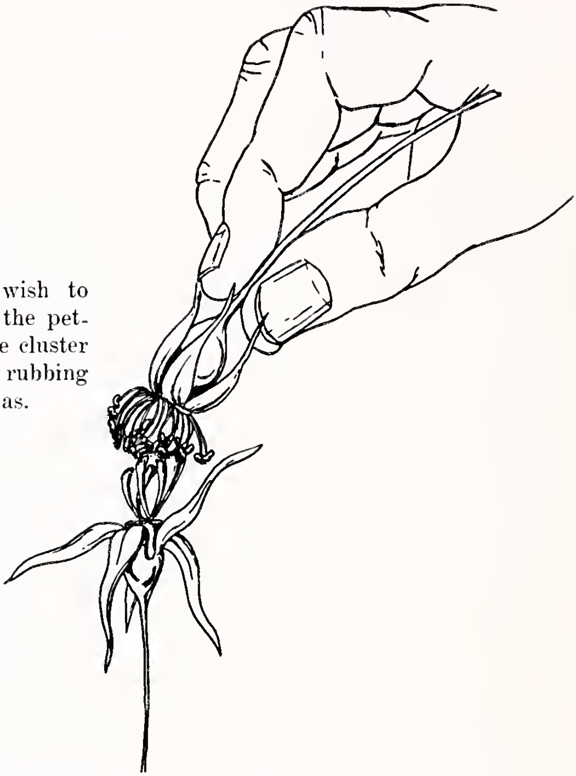
Stamens are removed and flower is covered with small bag for a day or two until stigmas (tips of pistils) become sticky.

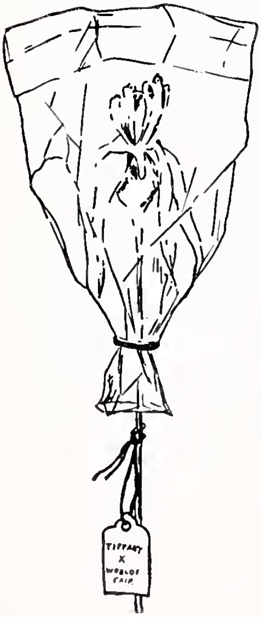




Pollen is collected from anthers of male parent and applied to sticky stigmas with a camel's hair brush. With brush technique it is important to dip brush in 95% alcohol before changing to different pollen for a new cross. Brush should be dry before re-use.

The amateur who does not wish to bother collecting pollen can pull the petals off the male flower and use the cluster of stamens themselves as a brush, rubbing the pollen directly onto the stigmas.





The pollinated stigmas are immediately covered with a bag, and labeled with the names of the parents. When hips (rose fruits) start to swell, bag may be removed. Seeds should be stratified before planting to insure good germination. They are placed in jars in damp (not wet) peat moss and kept in a refrigerator for about 3 months. Then they are planted in flats, or if weather permits, in beds out-of-doors.

Why have we not had tall rose bushes, self-supporting, that bloom the first year like Hybrid Teas and on canes the year those canes grow, year after year? Why not roses that form bushes 6 or 8 feet tall, everblooming, or that climb to the roof of a garage and there bloom on all stems, branches, and canes as fast as they can grow, until frost?

The answer is clear and simple:

The everblooming Hybrid Tea and the tall-growing, once-blooming climbers will not combine everbloom and tallness by breeding; and the seedlings of those crosses will not produce the desired flowering characters. The rose hybridizers have sought that combination for more than 100 years in vain.

But now comes Mother Nature who has produced by mutations over a period of many years a number of different varieties that do contain in their constitution both tallness and everbloom; in their fullness, selections from these have produced a new race of Everblooming Climbers, that repeat like Hybrid Teas. *Nature has done it.*

Hundreds of varieties in various forms and colors are being brought into being each year by special breeders; and from these one or two varieties are selected for distribution.

Future Outlook

Perhaps some readers would like an interpretation of the future development of this new and complete combination of the everblooming quality with the vigor and tallness of Pillars and Climbers, that nature has through its processes of evolution given to the Rose World. It is something of very great importance.

In this connection it is well to note that there can be many varieties with an incomplete combination of everblooming and once-blooming qualities. Some of those that have previously been obtained are well known, such as New Dawn, Dr. J. H. Nicolas, and Orange Everglow. But these do not have in their constitutions the fullness of that combination that the selected varieties of this new race have.

Author photo

The yellow V for Victory, one of the Brownell sub-zero Hybrid Teas.

Just how will such a new race influence rose gardens of the future, during the next half-century? For comparison, let me greatly exaggerate the situation by reminding you of past developments not promptly foreseen. Had you heard my bellowing voice in 1880 over one of the fifteen telephones in Providence, Rhode Island, would you then have believed that that city would now be equipped with 100,000 'phones? Had you, a few years later, been in the contest of horseless carriages racing from New York's 5th Avenue Hotel to Yonkers, less than 20 miles away, the winner taking nearly 6 hours, could you have dreamed of crowded highways as they are today? When we read of Marconi's wireless telegraph succeeding in spanning the Atlantic, could any of us have visualized himself sitting at home with today's television?

Of course these things are of interest and importance to everyone while a new type of rose plant can only be of most interest to gardeners. But there are many million gardeners! As the new rose combines sturdiness, tallness, and the beauty of everbloom, it can end many a rose gardener's discouragement. From tests it is evident that these new roses have the hardy sturdiness of the *Rosa wichuraiana* climbers. There is no limit to the number of varieties that may be produced.

Here is a summary of the outstanding qualities of this new race of Everblooming Climbers:

They bloom the first year they are planted as freely as do Hybrid Teas.

They can be cut back like Hybrid Teas to any height desired.

The canes bloom as they mature, in clusters or racemes, the same year they grow.

The stems and canes continue to branch and bloom until frost.

In color, form, size, and fragrance the blossoms compare favorably with those of the present Hybrid Teas.

Some varieties are sufficiently self-supporting to form that needed specimen bush for the lawn, 5 to 8 feet tall.

Some can be grown as pillars or climbers on racks or trellises.

Others have branched canes to lay on top of some building, such as a garage, to bloom there like Hybrid Teas and still others will lie by the roadside, on banks, or over walls and fences.

Their sturdiness renders them as easy to grow lilac, philadelphus, and forsythia.

What other bush is there that grows north of the semi-tropics today, that can show such variation in plant form with such beauty of flower color, and also bloom so constantly? There are in the breeding grounds at Little Compton, Rhode Island, such plants 6 years old, the first 2 years hoed and cultivated, the last 4 years in competition with weeds and brush and having no cultural attention. From these are gathered thousands of hybridized seeds each fall.

This, then, is our prophecy of "What makes a rose" for the future, based on over 50 years of nearly full time work with roses.

SOME OF THE BROWNELL HYBRID ROSES

Sub-Zero* Hybrid Teas

(*Bloom All Season*)

Handsom Red—glowing red
Queen o' the Lakes—deep red
Red Duchess—rose-red
Curly Pink—two-toned pink
Lily Pons—white, yellow center
King Boreas—lemon-yellow
Yellow Ruffels—yellow
Orange Ruffels—glowing orange

Everblooming Pillars

Eight varieties of climbers that bloom all season like Hybrid Teas

Resistant (relatively immune) to Blackspot

Pink Bouquet
Orange Ruffels
Yellow Ruffels
Red Duchess
Pink Princess
Dolly Darling
Lafter
Curly Pink

Sub-Zero* Floribundas

(*Bloom All Season*)

Dolly Darling—pink
Yellow Curls—yellow
Lafter—orange and yellow
Anne Vanderbilt—copper

Brownell Hardy Climbing Roses

(*Bloom in Early Summer*)

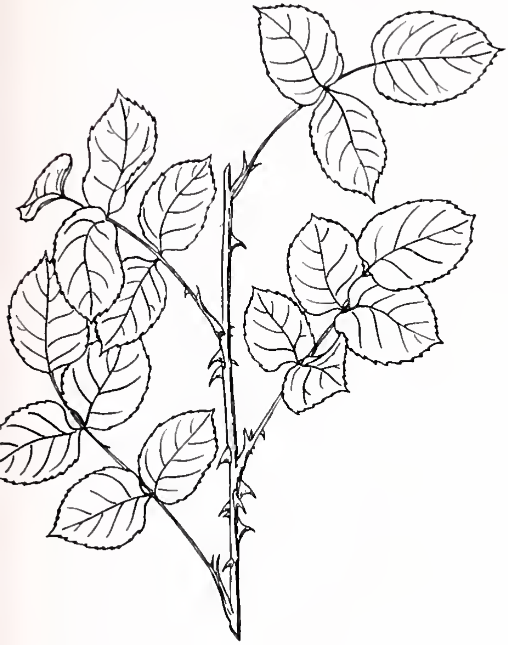
Climbing Red Duchess—red
Golden Climber—yellow
Golden Orange Climber—orange
Climbing Break O'Day—orange to apricot

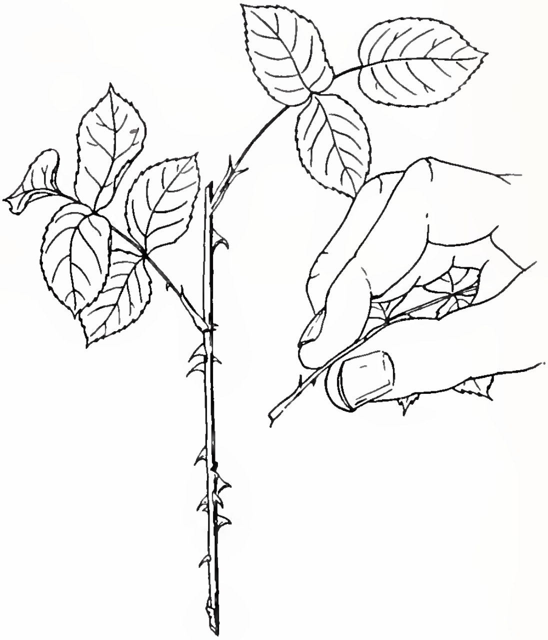
*Ability to withstand winter killing is more than merely a resistance to cold; even perfectly hardy roses may die in winter if they have received improper care or are in poor condition from any other cause.—Ed.

Growing Roses from Softwood Cuttings

Many roses, especially shrub roses and climbers, can be grown from cuttings; most Hybrid Teas are difficult to reproduce in this way. Miniatures root easily.

Left, cuttings about 8 inches long, with four leaves taken from flowering shoot between time of first color and petal fall. Cut should be made ⅛ inch below bottom leaf.
Right, two lower leaves are removed, as well as all but two leaflets of remaining leaves (see sketches below).





Left, cuttings are inserted about half their length in bird gravel or very coarse sand and watered. It is important that the medium be tamped very firmly about the base of the cutting. If rooting hormone is used, bottom inch of cutting is dipped in this before planting.
Center, if desired, cutting may be covered with a fruit jar or shelter of polyethylene film. This helps prevent wilting, but excess moisture which encourages decay must be guarded against.
Right, when shoots begin to grow, jar should be removed. Roots may be expected in 6 to 8 weeks; when they are ½ to 1 inch long, cutting should be transplanted to soil.

IDEAS FOR ROSE PLANTINGS

Rose plantings often lack that elusive quality which may be called "gardenesque." It is not necessary to confine roses to unimaginative rectangular beds and borders. Here are fifteen ideas for using them in many settings and to serve various horticultural ends.

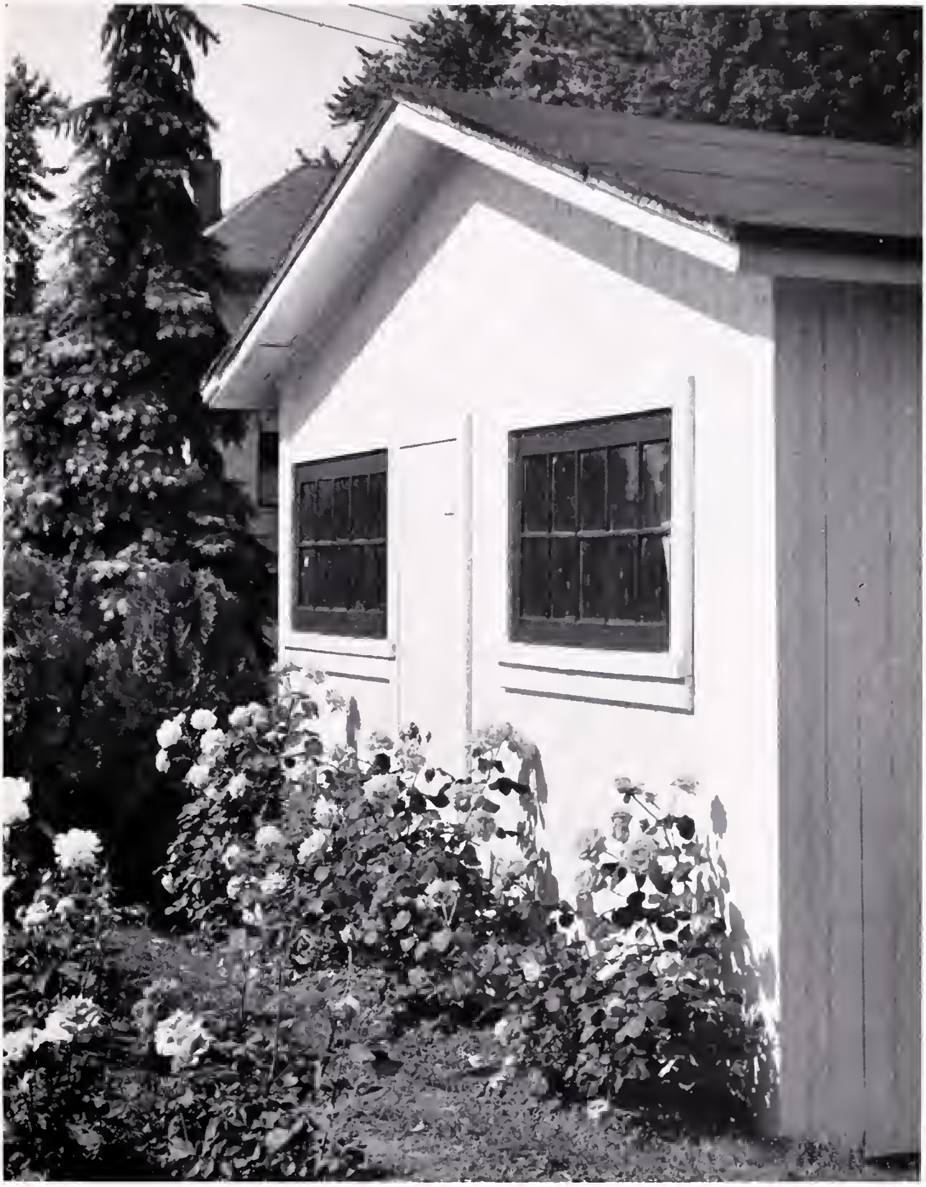
Roses along this weathered rail fence make a charming garden boundary.

Gottscho-Schleisner photos

Border of roses brings living color and softened lines to this fine flight of stone steps.

McFarland

Climbing roses help to hide and give a touch of beauty to necessary but unattractive structures such as garages or sheds.



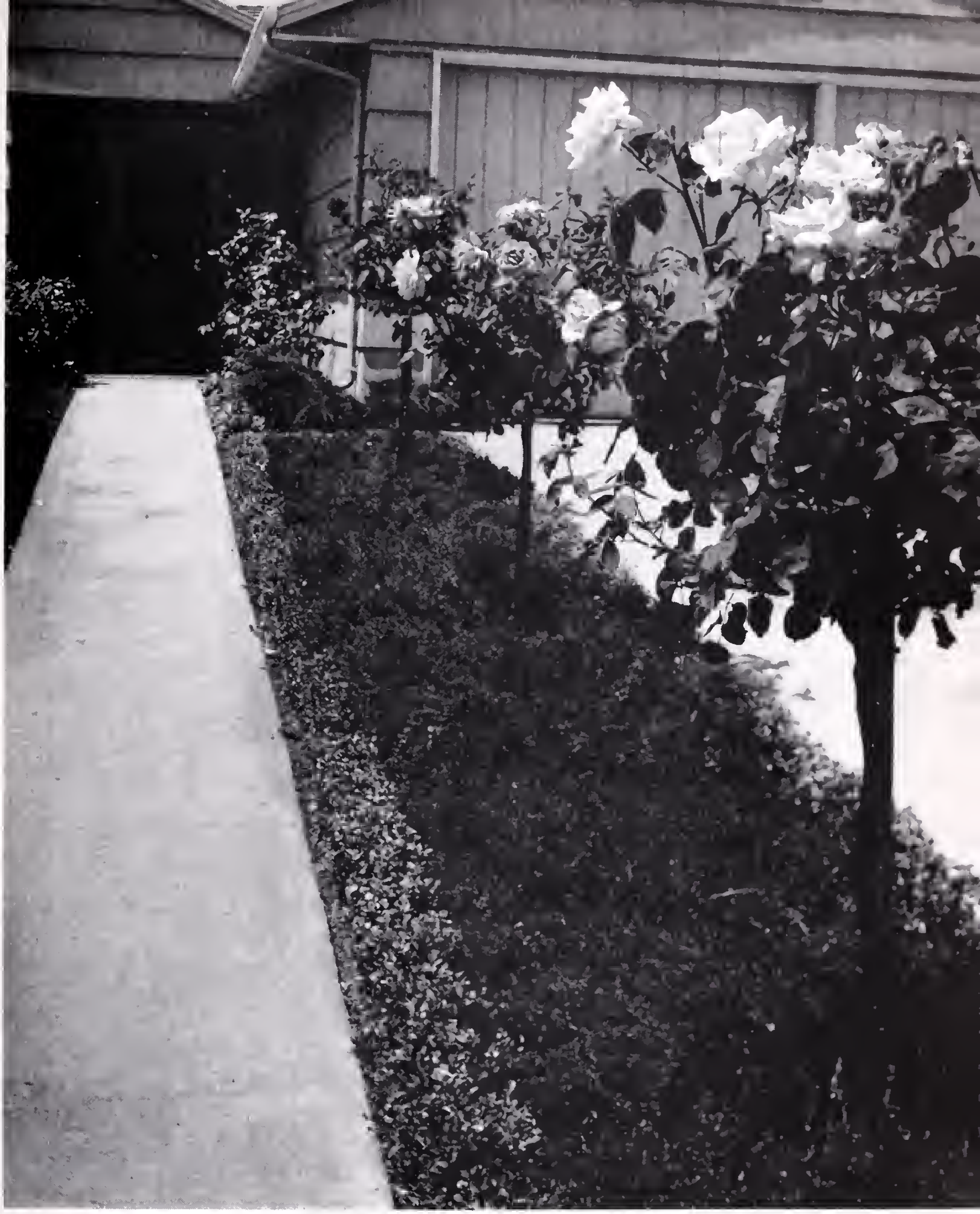
Gottscho-Schleisner

The stark white wall of this simple shed is relieved by a planting of roses.

Hybrid Tea rose border along walk through vegetable garden provides color in the garden as well as a supply of cut flowers for the house.

McFarland photos

Rose borders by entrance walk provide color as well as a cutting garden where the late-home hasty hostess can snatch a bouquet as she approaches the front door.



Weymouth

This unusual separation of walk and driveway is accomplished by a row of tree or standard roses. Best suited to warm climates, tree roses can also be grown in temperate regions if protected in winter.

Roses are here planted in the usual rectangular beds but marginally placed and with an ample grass plot in the center. Such treatment avoids to some extent the monotony and rigidity that characterize many rose gardens.

For a small city back yard this border planting of roses provides a wealth of color and flowers for cutting, in a limited space.

McFarland photos

Roche

Roses along the picket fence make this entrance warm and inviting.

McFarland

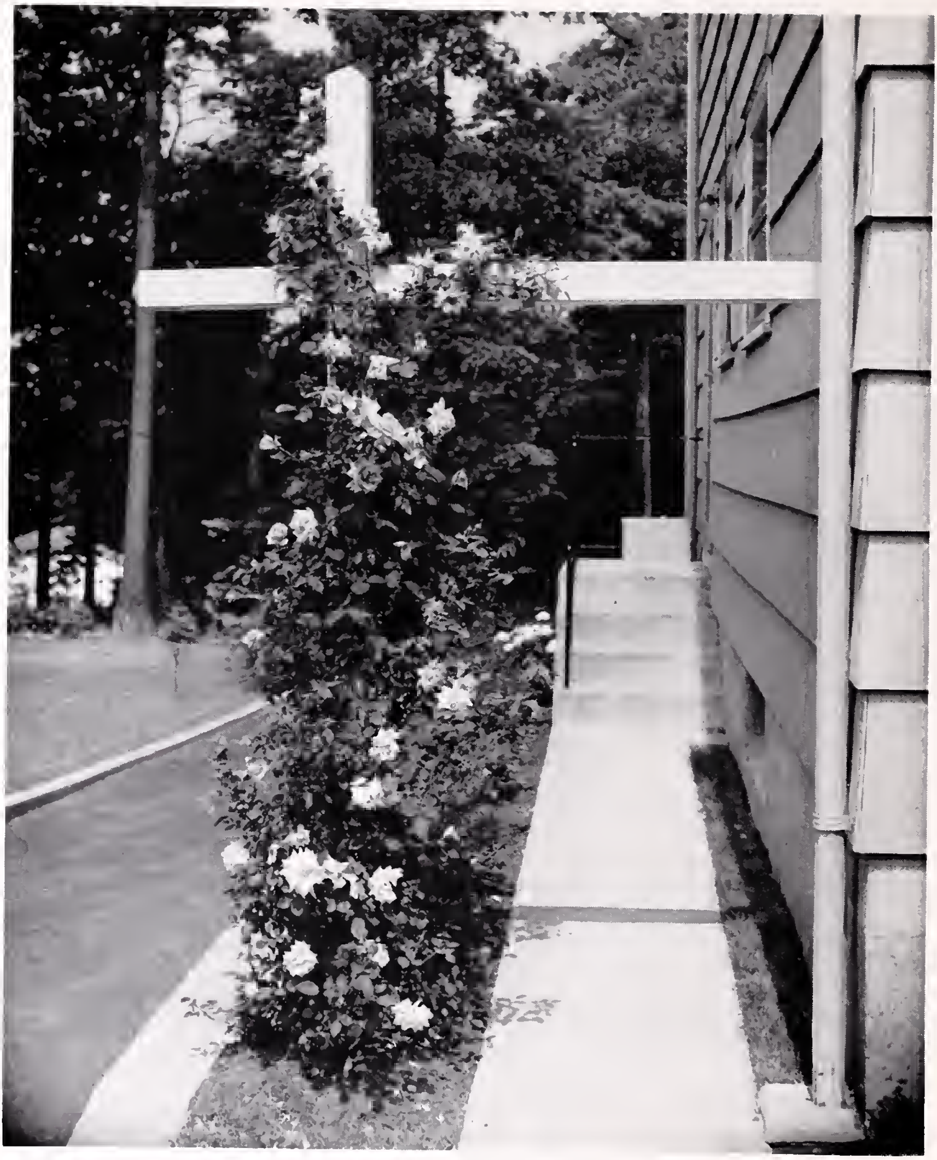
A Large-flowered Climber brings summer interest to any small, fenced-in garden.

Paul's Scarlet Climber gives a colorful touch to rather formal brick wall.

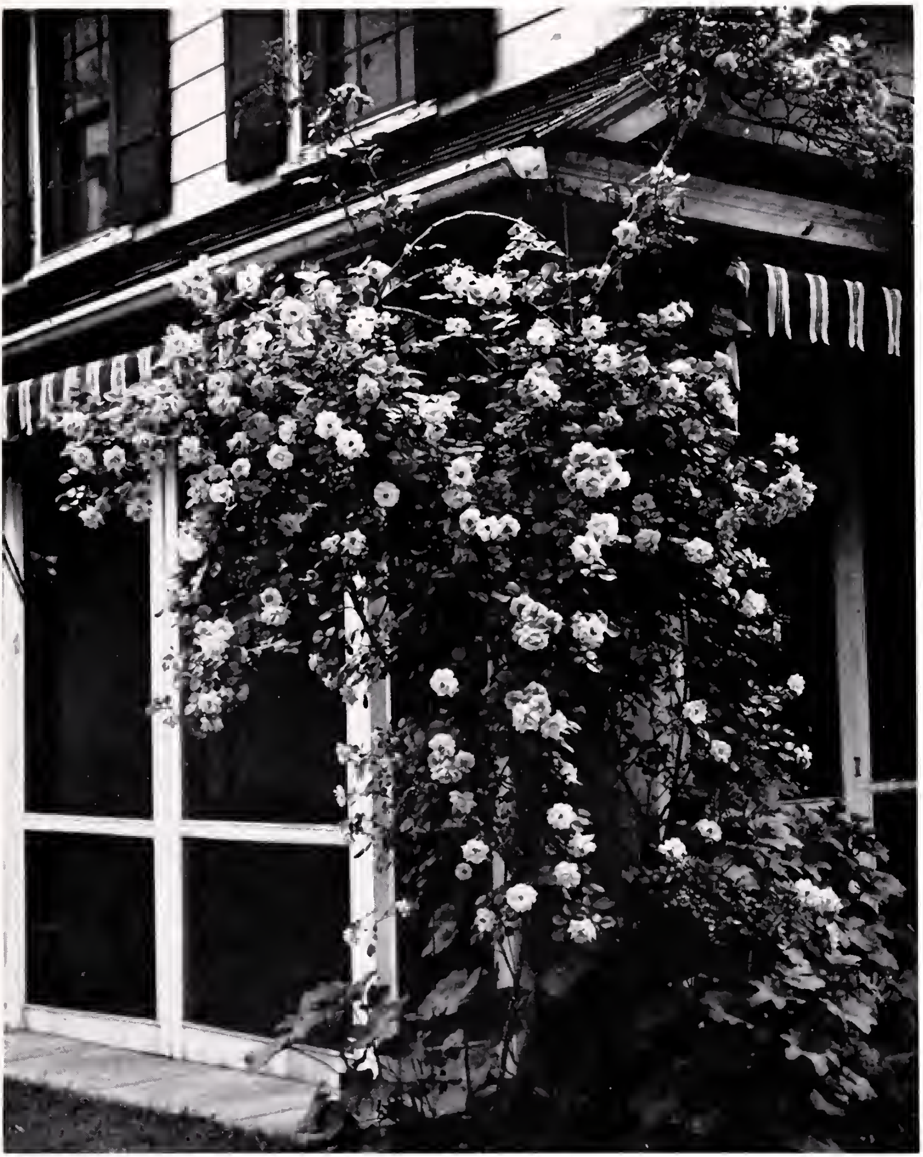
McFarland

Unusual treatment of climbing rose Silver Moon—trained to grow as a specimen plant.

Roche

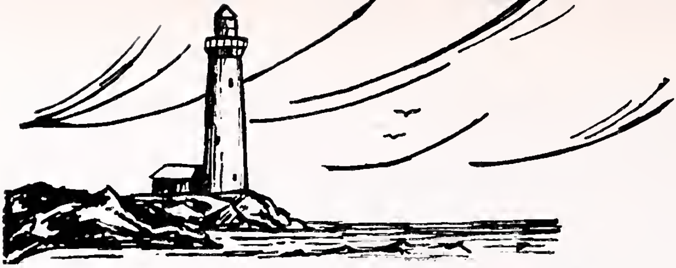


A vertical "cutting garden" in a very small space is provided by this Large-flowered Climber.



Roche photos

Traditional placing of a climbing rose brings colorful note to the corner of this plain screened porch.



GROWING ROSES

ON THE NEW JERSEY SHORE

George E. Lippincott

BY SEASHORE I do not mean the rock-bound coast of Maine or the Rugosa-covered meadows of Cape Cod, but rather the New Jersey sand reaches and dunes where roses can, with special planting, be made to grow within 200 or 300 feet of the ocean surrounded by pure seashore sand.

The only rose I have found that will grow and flourish with its roots in pure sand, exposed to the heat of the full July sun, is the MAX GRAF, a Rugosa hybrid. I have seen this rose in full bloom where the sand is too hot for the bare foot and the sun, as Kipling says, "Would make your bloomin' eyebrows crawl." One wonders how they grow with no water except from the sky when it rains and little of that in a drought. The answer may be leaf absorption of water from the heavy dews prevalent near the ocean.

Sand plus salt air seems to stunt growth and those roses, even Ramblers, that exist are runts. *Rosa carolina* grows wild along the roadside well away from the ocean where it finds something better than pure sand for its roots to get hold of.

Culture

A 100-pound bag of peat moss dumped on the sand will sink and disappear in a few days, if not overnight. I find the answer to rose growing in second-hand peach baskets lined with one thickness of newspaper and filled with good, well-composted earth in which the roses are planted. Dig a hole in the sand behind a dune where it is protected from the direct ocean wind, drop in the basket with the rose still planted in it, tamp in earth around the edges of the basket and that's all there is to the planting. The basket will rot away in a year or so, but by that time the rose bush is established and growing. This system can also be applied where there are steep hillsides subject to erosion.

No winter protection is needed on the New Jersey coast but in summer a mulch of peat moss helps in retaining soil moisture. It would be ideal to grow all roses in a lath house in our section of New Jersey.

In peach basket planting you don't have to worry about all the rules and regulations on preparing a rose bed; there is always good drainage and no puddles for the roses to stand in with "wet feet." Thus, many good points will offset the bad. Along the seashore, rosarians rarely get something for nothing, unless it be the MAX GRAF that grows without care, or the beautiful *Rosa carolina* that grows wild by the roadside.

In spite of the fact that *Rosa carolina* will stand the hot sun, most species roses do not flourish. *Rosa foetida bicolor* or AUSTRIAN COPPER, will not take it even if planted in a basket, well mulched and watered. *Rosa hugonis, R. moyesi, R. omeiensis, R. spinosissima altaica, R. foetida,* HARISON'S YELLOW, etc., are not happy and show it. Yet our own native prairie rose, *Rosa setigera,* too much neglected in American landscape plantings, will really thrive, with growth well up to 12 feet in a season and lots of bloom, much appreciated because it flowers later than most other roses. This rose flourishes in what is practically nothing but railroad cinders by the right-of-way, some 400 feet from the ocean.

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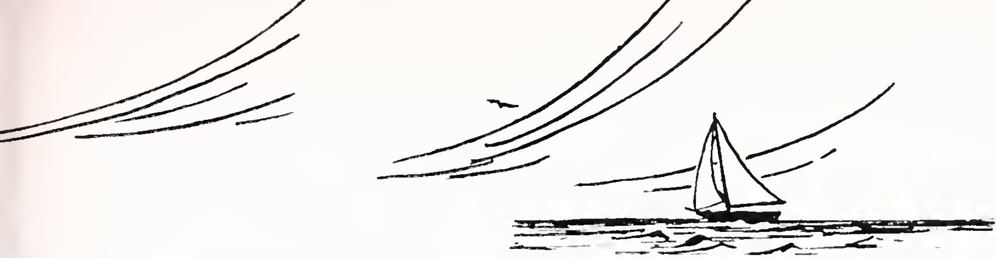

T THE SEASHORE

ON AN ISLAND OF SAND

Edwin Cox

ON the opposite page one seaside rosarian recounts his experiences in growing roses on the New Jersey shore. My own results, with a garden of about 300 plants at Point O'Woods on Fire Island, may be interesting to readers.

A dozen years ago, when I first thought of planting roses at Point O'Woods, I read everything I could find on the subject. The old masters (mostly English) were uniformly discouraging about growing roses in sandy soil.

Pemberton said that a sandy soil containing less than 10% by weight of clay is "useless for all roses." Foster-Melliar wrote: "But in sands like that to be found at the seaside . . . I fear the Rosarian must stifle his impulses, change his object of worship, and devote himself, according to the extent of his holding, to hyacinths or partridges." Or listen to the good Dean Hole: "I know of only one soil in which the attempt to grow grand roses would be hopeless . . . and that is the light barren sand called "drift" and "blowaway" of which the clay farmer said derisively that it might be ploughed with a Dorking cock and a carving knife."

Not very much encouragement! Yet my roses today are as robust and healthy as any I have seen in most parts of the United States or abroad. They become so not by fancy bed preparation, or by my importing any topsoil, but primarily by the generous use of humus.

Soil

Fire Island is a barrier reef, ten miles off the south shore of Long Island, and was originally pure quartz sand. As various kinds of beach vegetation got started, humus was naturally added to the soil, and in the older parts of the island, where the organic content of the soil is greatest, beach plum, shadbush, highbush blueberry, holly, and other seaside plants abound. The ability to support vegetation is almost in direct proportion to the amount of humus in the sand.

My own cottage, in a swale about 200 yards from the surf, is protected on the seaward side by a natural thicket of the plants I have mentioned, and the garden is surrounded by brick walls. I made my beds to a depth of 2 feet with about 25% peat moss, and add to this every year a 2-inch mulch of the same material which is dug in during the fall. No fertilizer was incorporated when the beds were made, except a little bone meal; all other feeding is from the top.

The soil is analyzed each year, and a feeding prescription prepared. There is fairly rapid leaching in the sandy soil, and I probably feed a little more often and in smaller amounts than most people. The plants are also quite heavily irrigated. I use plastic sprinkler tubes turned upside down so they become soakers, and leave them in the beds all season. These are attached to terminal fixtures made of pipe and equipped with snap-on attachments for the hose.

Potted Bushes

I have had good success with roses started in large paper pots containing about 15 lbs. of soil. My nurseryman prepares them for me on special order, and I take them out by car and boat. I began this because of inability to get

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Climbers

There are some hundred or more ramblers that are going out of commerce because of their susceptibility to mildew. From the heavy seashore dew I expected my Rambler Pillars on cedar poles that line the driveway to be thick with mildew. Not so. The sun burns it off and nothing gives a greater mass of bloom nor is more spectacular than a driveway of Rambler roses. All climbing roses do well but the seashore is the home of the Ramblers.

Of the Climbing Hybrid Teas, PICTURE and CORAL PILLAR are about the best for pink roses that will bloom up until December in New Jersey.

On account of the heat the seashore is no place for Hybrid Perpetuals although SUNDAY BEST, and SPANISH BEAUTY, both listed as Climbing Hybrid Perpetuals, are able to grow and do well.

Bush Hybrid Teas

Bush Hybrid Teas should have some protection from the full day sun. A bed of fifty FASHION roses which gets about 4 hours of sun, is a sight to behold (for the Floribunda class) both in spring and fall. But keep the hot morning seashore sun from them if possible. MASQUERADE seems to stand a little more sun and always attracts the eye with its changing colors. All this, remember, among the sand dunes, close to the ocean, and planted in peach baskets.

Climatic Problems

The last two winters have recorded a low of 16°F. and that, I believe, for only a short period. Snow hardly ever lasts for more than a day.

Summer nights at the seashore are cool, too cool to grow corn which does most of its growing during warm summer nights, and that's why people go to the shore in summer. Cantaloupes or watermelons dry out but do well a mile or so inland, whereas cucumbers grow so big at the seashore they have to be cut with a carving knife. It is these temperature contrasts and bionomical conditions that roses have to contend with in the dunes. One must be an empiricist in rose planting at the seashore. I know of no written guide book.

As elsewhere, and even more than in most places, roses at the seashore have to be fed bone meal as well as a rose food. One can see them respond to both. It helps to keep the hose going on the leaves.* This may promote black spot, but won't give the foliage more water than the night's heavy dew. Seashore sunlight is so intense that many roses do better on the north side of a building than on the south side. High wind is also a problem and roses must be well staked.

The Experimental Approach

The great possibilities at the seashore are to be found only by experimentation.

Year before last I planted GLOIRE DE DIJON, a Climbing Tea dating from 1853. It is now at 8 feet. Last spring a Noisette, BEAUTY OF GLAZENWOOD, went in. So far it is coming along nicely and I believe will retain some of its leaves all winter. This year it is to be a MARÉCHAL NIEL—a real test. MERMAID, that disease-free bracteata, blooms all summer long in full sun. And of the bush Rugosas, SARAH VAN FLEET does the best. It is planted in partial shade.

Pests

Rose bugs, all kinds, the eating, spitting, masticating, and perambulating varieties, are with us continually. They seem to thrive on salt air and defy arsenate of lead. Rabbits love young rose twigs but chicken wire will frustrate them except when they work in a group of four. These dune rabbits must belong to a union. I can almost see a boss rabbit back three other rabbits up to the wire and at a signal have them kick with their hind feet and raise the wire. The boss rabbit, of course, is always the first under the wire.

These, briefly, are the things one must contend with in growing roses on the sand dunes by the ocean. But one can grow fine roses that people will come to see by using the peach basket method of planting.

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*This practice, though contrary to generally recommended procedure, obviously works for the author.—ED.

(*Continued from page* 151)

down to the shore quite early enough to set out dormant plants. But I have since learned by experience that, in my location, such potted roses thrive better than the dormant ones, due perhaps to the good start they get in the potting soil. They are, of course, planted without breaking the balls of earth, but I have found that the root system in a year or two will spread to at least twice the size of the ball. Many of the plants are now 6 to 7 years old and are as robust as any dormant-planted stock I have seen. My winter losses are small; not over 1%.

Pests

Diseases threats and pests are normal, except that we do not have the Japanese beetle. Only an occasional one manages to get across the 10 miles of water from the mainland each summer, and I don't think their grubs like the sand. I spray every week end from mid-April to mid-October with a general-purpose spray that I mix myself (sulfur, fermate, DDT, Lindane, and Aramite) and, except for occasional signs of mildew on a few susceptible varieties, disease and pest control are practically complete. But this is after many mistakes in the first few years.

To sum up, I believe the most essential point of the program is the very liberal use of humus (derived in my case from peat moss) not only to improve the physical condition and water-holding capacity of the soil, but to provide a basis for bacteriological action which transforms nutrients into forms the plants can use. With enough peat moss I wonder if fine roses could not be grown along most of the beaches of the temperate zone, despite the apocalyptic warnings of the rosarians of a few years ago.

The author's rose garden at Fire Island. IMPROVED LAFAYETTE (crimson) and WHITE FINCH in beds, PROSPERITY (white) on wall.

Author photo

A single blossom of PEACE and a bouquet of the Miniature, SWEET FAIRY.

Courtesy Star Roses

MINIATURE ROSES

If you can't have a full-sized rose garden, try growing some of these delightful dwarfs

Roberta Lord

MINIATURE plants possess a fascination that is about inversely proportional to their size: the smaller the plant, and the more unbelievable it is, the greater its appeal. This, however, does not often include plants that are merely minute and nothing more (the fanciers of yeast, for instance, are largely confined to its dealers, or the bakers and brewers), but applies mainly to plants that are authentic and striking mimics of larger, well known types or varieties. This fascination was amply displayed by visitors at two Brooklyn Botanic Garden exhibits at New York Flower Shows: the bonsai exhibit last year and the collection of naturally dwarf or slow-growing plants shown a few years before.

True Dwarfs

In the latter exhibit were some Miniature roses. These always attract considerable attention, wherever they are. It takes no knowledge of plants or horticulture for one to find an appeal in these fairy-like Peter Pans. Children and non-gardeners love them on sight, though more knowing gardeners can probably appreciate them more thoroughly. Most people's reaction on seeing them for the first time is, invariably, an amazed delight, but usually a delight at what is believed to be a clever trick. They just don't believe the plants and flowers will stay that way! They think it is bonsai art, or that the plants are small only as a kitten or baby is small. If told that these are really full-grown plants, they still don't quite believe it, usually, until they have actually grown some of them.

The Miniature roses are exact mimics of the big roses, with gem-sized buds and dime-sized blossoms as precisely formed as the most perfect Hybrid Teas. They are fully double, with some 40 to 60 petals in each tiny bloom. Everything else about them is also an exact but tiny aping of the big roses: their woody stems and bushy habit, their foliage, and their absurd little thorns. A close-up picture of a Miniature rose plant is the same as a much-reduced print of a Hybrid Tea photo. Therein, lies their greatest charm.

Important to gardeners, however, is the fact that Miniature roses are as hardy as their bigger relatives and that, like them, they bloom from spring to fall. In fact, the Miniatures come into bloom earlier than the Hybrid Teas and, with the same kind of care, will outbloom them right through the summer and early fall.

Where to Grow

Miniature roses can be grown as house plants but, by most people, for a short time only; modern houses are usually too hot and dry for them to endure for long. Outdoors, they will flourish with ordinary good gardening care. They especially like a rock garden situation or crevices beside stone steps or walks. They can be grown as an attractive edging for a walk or flower bed, or around the base of a sundial or other garden feature. They like sun and air, the same as other roses, and a good soil, rich in humus.

Miniature roses can be grown in window boxes, terrace pots, or strawberry jars, if given adequate regular care, especially in regard to watering, and they are particularly attractive for this use, with their diminutive size and long season of bloom. They are popular as children's plants in a family garden, and many adults as well as children enjoy making a little Miniature rose garden with them, with walks, garden furniture and ornaments all scaled to their fairy-like size.

Lost to Cultivation

The true Minature roses grow about 6 to 12 inches tall when grown on their own roots; rose plants larger than that should be classed as Polyanthas and not true miniatures. A Miniature rose was known in England early in the 19th century. It is believed that it was a form of *Rosa chinensis minima* and that it was brought by traders from China or Japan. Drawings of it appeared in the "Botanical Magazine" of 1815. There are records of two later varieties, one credited to Redouté in 1821 and the other to Mauget in 1827. Later, for some reason, all the little roses were apparently lost to cultivation.

Rediscovery

It appears to have been a good part of a century later that a Minature rose was again found, on a window sill in a Swiss cottage. There have been printed varying accounts of the discovery, but the stories agree that the little rose was then propagated by Henri Correvon, a Swiss nurseryman, and named by him ROULETTI, for the man who discovered it. Some authorities believe that it is the same as an earlier variety that had been called POMPON DE PARIS.

Whatever its original name, that little rose is now widely grown and is an ancestor of a number of new varieties, most of them even smaller than itself. Eleven Miniatures have been patented so far in the United States, almost all of them

A garden of Miniature roses.

Buhle

Plant of Miniature variety Baby Gold Star (yellow) showing perfect form of leaves and flowers.

originated by John de Vink, of Boskoop, Holland. All were introduced and made available and known in this country by Star Roses, of West Grove, Pennsylvania. In fact, it was through this nursery's interest and persistence that adequate commercial methods of propagation and marketing were developed, and that it was made financially possible for John de Vink to spend much time in the development of new varieties. Now, others have become interested and other hybridizers are at work, both in this country and abroad. Home garden interest in them has also spread from this country back to Europe and they are being offered by nurserymen there as well as here.

Varieties

This year, for the first time, a Miniature rose appears among the "top 24 rose varieties" as determined by the latest National Rose Survey conducted by the American Rose Society. This is Sweet Fairy, introduced in 1946. It is pink and fragrant. The first one developed from Rouletti was the red Tom Thumb, introduced in 1936. This was followed in 1940 by the white and pink Pixie. The popularity of both these varieties has been increasing ever since, right along with newer kinds. Baby Gold Star, the only yellow, was developed by Pedro Dot, of Spain; Midget, rose-red, and the brilliant crimson Red Imp are also especially popular kinds. Newer varieties are Cinderella, white, and Bo-Peep and Tinker Bell, both pink.

Miniature rose blooms are in demand for the miniature arrangements that are now so popular. They are also used for place-card ornaments, corsages, and boutonnieres. For any kind of personal adornment, they are living gems, indeed.

Photos courtesy Star Roses

Bouquet of white and pink Miniature rose, Pixie.

SHRUB ROSES

Grown as specimen plants or in combination plantings, shrub roses are worthy of wider use

Robert Eisenbrown

THE very term "shrub roses" is such a broad one that perhaps it deserves some explanation. For years it has been the term applied to both old and new roses outside of the popular Hybrid Tea, Polyantha, Floribunda and Climbing rose classes. Now within the past year or two, there has been a new term, Grandiflora, applied to a certain class embracing new varieties growing to a height of 5 to 7 feet or more and of greater spread than other strong-growing, everblooming roses. The term Grandiflora was originated by members of that great organization All-America Rose Selections, Inc. and perhaps I might be taken to task for mentioning this brand new term in connection with shrub roses. The way I see it, however, it is a much needed term and might be applied equally as well to some of the older shrub roses that we here at Bobbink & Atkins have been growing and specializing in for many, many years. We have always applied the term shrub roses to Rugosas and their hybrids, also to newer tall and sturdy-growing roses such as Autumn Bouquet and Fragrant Beauty. Then too, there are many self-supporting Pillar roses of moderate height that may well be called shrub roses.

Use With Other Shrubs

But now to get down to some specific examples of worthy varieties coming under this general head. For many years I have advised the use of shrub roses right along with other deciduous shrubs, which roses really are. Fine effects can be achieved by planting some of the repeat-blooming shrub roses and even old-fashioned roses along with lilacs, weigelas, deutzias, euonymus, and many other fall- or spring-flowering shrubs. Come June and even October, there are the roses poking their blossoms out of what might otherwise be a drab and uninteresting shrub border. This idea is nothing new and nowadays we are recommending Polyanthas and Floribundas to face down taller-growing deciduous shrubs and even evergreen plantings.

Primrose and pink Rugosa hybrid Dr. E. M. Mills.

McFarland

Courtesy W. Tillotson

EMPRESS JOSEPHINE, a silvery pink Gallica.

New Types

We might particularly mention some of the newer shrubs like AUTUMN BOUQUET and FRAGRANT BEAUTY, two very fine, hardy, and truly everblooming varieties in shades of pink and carmine-rose. Right now it would be in order to include the new All-America selection QUEEN ELIZABETH which we have seen growing up to 6 to 7 feet or more. BUCCANEER, CARROUSEL, and ROUNDELAY come in this same class. If we want to go into older originations it is right to include GRUSS AN TEPLITZ and NATIONAL FLOWER GUILD (probably no longer in commerce but a dandy). The fine, big, rambling shrubs, BIRDIE BLYE and ZEPHIRINE DROUHIN (Bourbon) are always treasured for their reblooming habits although they do take up a lot of room. One I am particularly fond of, and a real gem in the opinion of the late Lambertus C. Bobbink, is BISHOP DARLINGTON, a lovely flesh-pink suffused with yellow. It reaches 4 or 5 feet and blooms continuously, a charming plant and flower indeed.

Older Types

We must include some of the historical varieties like HARISON'S YELLOW, *Rosa damascena* and *R. gallica* and their hybrids, ROSA MUNDI and the cabbage rose, VIERGE DE CLERY. Most of the aforementioned varieties are still listed in current catalogs published by nurseries specializing in roses, both old and new. I have not gone into color descriptions because space will not permit but very reliable descriptions can be found in catalogs and in the book, MODERN ROSES IV, published by the J. Horace McFarland Company. Many of the older repeat blooming Hybrid Perpetuals should be termed shrub roses and the following are recommended among many others — FRAU KARL DRUSCHKI, OSKAR CORDEL, and PAUL NEYRON. They will also bloom when kept pruned low and with good feeding they make excellent fillers in shrub borders.

Pruning and Shaping

The matter of pruning and shaping shrub roses is a story all by itself. Briefly, they should never be allowed to get out of bounds. Keep them rejuvenated and induce some new wood year after year. The old theory that shrub roses are once-blooming is entirely wrong because I have seen hundreds of old and newer varieties showing strong everblooming tendencies with just average care. Incidentally, most of them are healthy and pest-free.

Those who expect to be told the ultimate height and spread in inches or feet that shrub roses will reach will be disappointed with what I have to say. To old experienced nurserymen it has always seemed silly for any of us to answer questions about exact height when we all know that soil, culture, climate, and other factors beyond our control have such a bearing on the stature of plants.

For this reason no one can say without knowing all these details just how large a plant will grow.

Just feel perfectly safe to shape and regulate their height and spread any time it suits you. Experiment and have fun and remember shrub roses seldom die from pruning.

SPECIES ROSES FOR THE LANDSCAPE

Broaden your rose horizons by growing some of the world's beautiful wild roses

Roy E. Shepherd

AN unfortunately large number of rose lovers do not recognize the fact that the genus *Rosa* includes many roses other than the highly publicized "moderns". Undoubtedly a majority of these people can, and should, plant only the latter as they do not have sufficient space to permit or justify the planting of large-growing types that bloom but once a year; but for those who have the room, species roses have qualities that warrant their being more widely known.

Advantages of Species Roses

The species (native or wild) roses of the world are the ancestors of all the modern hybrid roses. They possess a certain charm and grace that is not found in man-created hybrids and they demand but little care. Although they are not everblooming the blossom production is abundant and extended, and the flowers are followed by brilliantly colored seed hips that prolong the period of attractiveness by several months. These hips attract birds to the garden, are pleasing to the eye, and are exceedingly attractive in flower arrangements.

In addition to these attributes the plants are hardy, less susceptible to disease than most modern sorts, and are quite tolerant in their soil and environmental requirements. Several of the species roses are desirable landscape subjects — in fact, much more so than many of the shrubs now being used. They are not designed to replace our present day rose favorites but they can be used advantageously in conjunction with them. Briefly, they should be classed as shrubs rather than as bedding plants. Some are ideal subjects for accent points in the garden, shrub border, and foundation plantings, as well as for use as individual specimens. Or they may be used to conceal an unsightly view, to form an impregnable hedge, to prevent erosion, or for naturalizing or roadside planting.

Available Kinds

Inasmuch as species roses are not available from most nurserymen, a discussion of this group, to be of practical value, should be limited to those that are easily obtainable. Therefore I will mention only those that are propagated by one or more growers and refrain, though regretfully, from any reference to the several good ones that can be obtained only through arboretums or collectors.

Starting "from the ground up" let us first consider a type that has proved to be of considerable value both as a ground cover and as a bank retainer. I refer, of course, to *Rosa wichuraiana* — the Memorial rose. The 2-inch, single, white, fragrant flowers of this species are produced freely in July on a half-evergreen prostrate plant that thrives under practically all conditions. New plants develop wherever the stems come in contact with the soil. This natural process of propagation continues and, if unhampered, a

Blossoms of Scotch or burnett rose (*Rosa spinosissima*) may be white, pink, or yellowish.

single original plant will soon cover a large area. Apparently immune to all pests and diseases, *R. wichuraiana* is a beautiful sight to behold when in bloom and is attractive over a long period, as the bright red seed hips that follow the flowers persist into the winter. It is actually a plant-it-and-forget-it ground cover as it requires no care and improves with age.

Rosa carolina is an ideal subject where a 3- to 5-foot plant is desired for naturalizing or hedging purposes. It spreads rapidly and is attractive in growth, foliage, blossoms (single bright pink), and hips. *R. nitida* is somewhat similar but rarely exceeds 2 feet in height.

For swampy or extremely moist conditions no roses (and few other plants) are better adapted than *R. palustris*. It attains a height of 8 feet and produces its 2-inch, single, pink blossoms over a long period.

R. spinosissima is at home in practically any spot. There are many hybrids and variations of the original type, which rarely exceeds 3 feet in height, is extremely thorny, and produces a large quantity of rather small white blossoms. For naturalizing or hedges it is surpassed by few roses. A variety, *R. spinosissima altaica*, is a well-balanced shrub rose of from 5 to 8 feet that produces an amazingly large number of big, single, white flowers over an extremely long period in early summer. There are few, if any, better all-purpose shrubs. The seed hips of all members of this family are large, black, and numerous.

The Rugosa roses, both the species and early hybrids, are durable and attractive subjects for landscaping as several are everblooming and the flowers, foliage, and fruits are attractive. They are as much at home in the sand dunes of New England as they are in the heavy clay soils of the Midwest.

R. hugonis (the Golden Rose of China) is probably the best known of all the species. The single, bright yellow flowers are produced along arching 6- to 8-foot stems very early in the spring. It thrives best when planted in poor soil and may prove a disappointment when pampered. *R. primula* is similar in blossom form, color, and season but is more rigid in growth and is not as tall.

A blood-red species rose, *Rosa moyesi.*

Bright pink native American pasture rose (*Rosa carolina*).

McFarland photos

For contrast in the planting there is no better rose than *Rosa rubrifolia,* the red-leafed rose. The blossoms are rather small and unimportant but the contrast of the foliage with that of other roses is very pleasing. Its ultimate height is about 6 feet.

I rather hesitate to mention *Rosa moyesi* although it is probably the most attractive of all species in blossom color. In this respect it is equaled by few, if any, of the modern hybrids. However it is a very temperamental species and may be either "sensational" or a "flop." When happy (in poor soil), it is a rather sturdy, but somewhat leggy, plant that bears very attractive foliage and large, single blossoms of a color that is best described as blood-red. The pitcher-shaped, orange-red fruits may, or may not, be produced abundantly. The plant is temperamental in this respect, too, but the fruits are to be hoped for.

There are many others but until American nurserymen and the public awaken to the value of the species roses in the landscape this list must suffice as the best of those available.

A ROSE THAT IS NOT A ROSE

References to a "Christmas-rose" that blooms in winter are often seen in advertisements in garden magazines, newspapers, and plant catalogs. Most of these make clear that this is not actually a rose, and indeed it isn't. Some ads are misleading and many people have been confused by them.

The Christmas-ros is a hellebore (*Helleborus niger*) and is not even in the rose family; it belongs to the large buttercup family (*Ranunculaceae*).

It is an interesting and beautiful plant, and blooms in winter when the weather is not too severe. The attractive leaves are evergreen; the blossoms are white, sometimes with a purplish tinge.

Hellebores like rich soil in moist, partially shaded locations. Once established the Christmas-rose is persistent, but it may be temperamental and difficult to get started.

Another species, *H. orientalis,* is sometimes called the Lenten-rose.

Buhle

Christmas-rose
(*Helleborus niger*)

THE BRITISH NATIONAL SPECIES ROSE COLLECTION

One of the most interesting and important rose collections in the world is to be seen at the John Innes Horticultural Institution, Bayfordbury, England. Here in the British National Species Rose Collection, have been gathered together species roses from all over the world. Begun in 1948, by 1952 the collection contained 700 plants representing 102 species and 82 hybrids between species. It is hoped that it will eventually include all the species that can be grown at Bayfordbury. Special emphasis has been placed upon obtaining the plants from the wild, since species roses cross with one another so readily that many of the so-called species plants which have been grown for a few generations from seed in nurseries and botanic gardens are no longer pure and do not fit the original descriptions.

In addition to the plantings of species roses, this collection contains several others of great interest not only to rose lovers, but to all gardeners. In one of these, the principles of genetics and culture are demonstrated and their significance made clear. This is done by planting species roses side by side with their hybrids, with mutations which have arisen from them, and with plants in which the chromosome numbers have been increased (polyploids). The differences and similarities between the parent species roses and their altered offspring can be readily observed. The effects of various understocks upon plants grafted to them are also shown, and so are the effects of different soils upon roses.

One section is devoted to species roses and garden varieties that were grown before 1900. This collection includes Gallicas, Centifolias, Mosses, Damasks, and Albas.

A living family tree of garden roses is one of the most striking parts of the collection. Serial beds occupying a quarter of an acre depict stage by stage the progress from single-flowered ancestral species roses to Hybrid Teas, Hybrid Polyanthas, and other modern favorites.

P. K. N.

Distant view of winding beds of species roses at the John Innes Institution at Bayfordbury.

Courtesy L. S. Clarke

McFarland

AN EVALUATION OF ROSA MULTIFLORA AS A HEDGE PLANT

There have been many recent references in catalogs and garden periodicals to the use of *Rosa multiflora* for hedge purposes. This species (the rose often used for understock with garden roses) has a real value for use in livestock fencing in open ranges and for use on large estates, but in the judgment of many who have tried it, it has no place in the average situation.

A mature plant may reach a height of 10 feet and spread over 15 feet in diameter, forming an almost impenetrable, spiny thicket. It is this exuberant, tangled, prickly growth which gives *Rosa multiflora* its value as a barrier against animals but also makes it an unlikely subject for use as a lawn or garden hedge. To keep it within bounds pruning must be frequent—and this is a most uncomfortable task with *Rosa multiflora.*

The tiny white blossoms are borne in clusters. They are attractive, especially when borne in profusion on mature plants, but here again, pruning removes most of the bearing wood, so plants trimmed as hedges bear few flowers. Moreover, the blossoms shatter too quickly to have much value as cut flowers. Blossoming precedes that of other garden roses by about 2 weeks, and the blooming period is relatively short.

So, for large properties *Rosa multiflora* may be just the answer to some of the fencing and hedging problems. For those of us who garden on smaller plots its numerous lovely descendants, the Polyanthas and Floribundas, are more appropriate.

Courtesy W. Tillotson

The deep red Hybrid Perpetual, HENRY NEVARD.

OLD GARDEN ROSES

Among neglected old-fashioned roses lie many treasures for rose growers

Leonard L. Eyster

THE lecture, with colored slides, had been advertised as "Old Roses For New Gardens." Before the lights went out, the audience stared politely at the speaker of the evening, noting the well-tailored clothes, the dark wavy hair, and above all, an undeniably youthful appearance. Above the murmurs of the group I heard someone ask: "Aren't you rather *young* to be interested in old roses?"

Goodness knows why, but to most people, old roses seem to mean doddering gardeners, gnarled hands, and white beards. Though in the public mind there is nothing strange about playing Bach at fifteen, collecting snuff boxes at twenty, loving antique furniture at twenty-five, and going in for old masters at thirty, a liking for antique roses seems to put one in a class with the Ancient Mariner!

There *is* a paradox, however, applicable to those who love old roses: to a man, they know, love, and grow the modern ones too. Just as the fanciers of old china own and dine from sets of new china, just as those who are devotees of antique furniture mix the old and the new in the same living room, so do fanciers of "roses of yesterday" mingle 100-year-old Gallicas, Damasks, and Chinas with the latest patented roses of today. I sometimes wish that more gardeners could thus escape from the strait jacket of taste imposed on them by the big nurseries, whose catalogs show little else than Hybrid Teas and more Hybrid Teas, Floribundas and more Floribundas. Beyond these two classes lies a world of fascinating roses of all kinds, some climbers, some shrubs, some pillars, and some bedding varieties. MODERN ROSES IV, a directory published under the aegis of the American Rose Society, lists some sixty-odd classifications, two of which are Hybrid Teas and Floribundas. Many of the rest belong under the heading of "old garden roses," and others, not so old, might be classed, conversationally, as "other rose types." The gigantic nurseries whose names are household words seldom carry either, but there are small nurseries that do have them at standard rose prices.

Before 1800

Prior to 1800, gardens in Europe and America contained such roses as the following: (1) **Gallicas**, known botanically as *Rosa gallica*, and in popular parlance as "French roses"; (2) **Centifolias**, the Provence or "hundred-petaled" roses; (3) **Damasks**, often divided into summer and autumn types; (4) **Albas**, or "The White Rose of York"; (5) **Musks** (*R. moschata*), and (6) **Mosses**, believed to have "sported" or mutated from the Centifolia class. There were, too, a few climbing kinds, such as *R. arvensis* and *R. sempervirens*. Generally, all of the above-cited sorts were "summer roses," meaning that they bloomed once and that's all. *Rosa damascena*, the autumn Damask, undoubtedly evidenced some remontancy under favorable conditions, and there was a strain of *R. moschata*, probably the Persian Musk, that definitely did repeat its bloom. Not a great deal is known, though much has been written, about the history of any of these classes. It is thought that *R. gallica* may go back in cultivation as far as the 12th century before Christ. The oft-repeated statement that the Centifolias are over a thousand years old has been impressively challenged, and I cannot find too much that is known of that fascinating class, the Damask. It is quite apparent, too, as rose history is studied, that too little is known of the Musks, especially of that variety of *R. moschata* that was one of the parents of CHAMPNEY'S PINK CLUSTER, the first Noisette.

Nineteenth Century

Rose history that is even remotely dependable begins around 1800. The decade before had seen the arrival of those sensational immigrants from China, *Rosa chinensis* and *R. chinensis semperflorens*, the first really everblooming roses to reach England and the Continent. Crossing these newcomers from the Orient with Damasks and Musks produced the Bourbon and Noisette classes, both repeating roses. In the next quarter-century, two more roses, HULME'S BLUSH and PARKE'S YELLOW, both Tea-scented chinas, added more China rose characteristics to the everblooming rose picture. The species just mentioned were, botanically, *R. odorata* and *R. odorata ochroleuca*.

The garden world of 1825 and its succeeding decade now had the enormous blessing of four everflowering rose types: Chinas, Noisettes, Bourbons, and Teas, many of them in climbing as well as bush form. Attempts to cross these repeat-blooming classes with such "summer roses" as the hardy and vigorous Gallicas and Centifolias resulted in the Hybrid China, a class that was husky and beautiful, but for the most part not everblooming and sterile. But the gene for everflowering was there, although recessive, and back-crossing the few non-sterile varieties such as ATHALIN and MALTON with Chinas, Bourbons, and Noisettes "broke through the barrier" and led to the spectacular Hybrid Perpetual class of rose. The Hybrid Perpetuals, though not perpetual and in some instances not everblooming, were nevertheless of such vigor, hardiness, fragrance, and bold color that

Tea rose (*Rosa odorata*).

McFarland

Roche

The fragrant pink Provence rose (*Rosa centifolia*).

for nearly half a century they reigned supreme on both sides of the Atlantic. Crossed, as they eventually were in the 60's and 70's with the Tea rose, they gave rise to a class that blended Hybrid Perpetual vigor and hardiness with the flower-refinement and bloom-frequency of the Tea. The new class was the Hybrid Tea which, in its modern and perfected form, is the queen of today's gardens.

Old Roses Today

Old roses, the precursors and ancestors of our present Hybrid Teas, may be obtained from nurseries here and abroad, and may be found growing, not only in old gardens, but in an increasing number of new ones. The striped and particolored Gallicas, the intensely fragrant Centifolias, the astonishing Mosses, the lovely Damasks, the tireless Chinas, the delicate Teas, the alluring Bourbons, and the climbing, cluster-blooming Noisettes all beckon to the rosarian of today with the deathless appeal of "roses of yesterday." I know of one garden where there are 50 named varieties of Hybrid Perpetuals alone. In fact, of all the old-fashioned types, the Hybrid Perpetuals seem the most readily obtainable. Anyone who aspires to the name of "rosarian" should grow at least a few of them. Everyone should have those lilac-pink beauties Mrs. John Laing and Paul Neyron. Both are deliciously fragrant, and Mrs. John Laing in particular repeats like a Hybrid Tea. Also listed among the Hybrid Perpetuals are pink, highly fragrant George Arends, frilled and ruffled Roger Lambelin, purple Reine des Violettes, intensely red Henry Nevard, and pink Baroness Rothschild, "crushed strawberries and cream," as one catalog writer puts it.

As we have seen, Chinas, Bourbons, Noisettes, and Teas were the original "everblooming" classes, and among them are some of the most beautiful of all roses. In the China category, Old Blush, found in catalogs and gardens for over 150 years, may still be bought. Seeing it put forth its unbroken succession of semi-double blooms all season long will give you an idea of what the China gene for continuous flowering contributed to rose gardens. Bourbon roses, too, are still obtainable, the "must have" in this group being Souvenir de la Malmaison, with flushed-cream, quartered blooms.

Then there is another Bourbon, Zephirine Drouhin, whose gay beauty makes such a tremendous first impression on all hearts. In the Noisette sector, the varieties most frequently encountered above the Mason-Dixon line are white Madame Alfred Carrière, cream-yellow Gloire de Dijon, and apricot-tinted William Allen Richardson, all outstanding as to performance and beauty, and hardier than other Noisettes of equal fame such as Alister Stella Gray, and Maréchal Niel. The Tea group is composed of varieties supposedly tender, but there are among them some that can survive northern winters with a little protection from their owners. Lady Hillingdon, Safrano, William R. Smith, and Maman Cochet are in this category. LADY HILLINGDON, as it is in my garden on the coolish first few mornings in June, is a particularly beautiful sight to behold.

Visit any place where old-fashioned roses are grown and you are sure to see, not only old roses, but a balanced garden resulting from a broadened and informed taste. You will find not only the best of the old *and* the best of the new, but interesting roses like the Hybrid Musks, and the hybrid species roses such as those derived from *Rosa spinosissima* and *R. rugosa*. All except the *R. spinosissima* hybrids repeat their bloom again and again throughout the summer and fall, and, even in this last-named class there are two, KARL FÖRSTER and STANWELL PERPETUAL, that are in continuous bloom. Not to know such roses as these is not to know the genus at all. This is particularly and even startlingly true of the Rugosas and their hybrids. He who hasn't seen and smelled purple HANSA, or blush-ivory NOVA ZEMBLA, or come upon BLANC DOUBLE DE COUBERT, white and glistening as an angel's wing and with fragrance to match, has missed an enormous amount of good seeing and good smelling. Rugosa fragrance is positively enchanting. The plant itself has beautiful crinkled dark leaves and, hailing as it does from northeast Asia, is hardy to an extreme degree. British authority G. S. Thomas says of the Rugosas: "These roses are the best *perpetual flowering shrubs* available for our gardens today."

Roche

Variety of China rose (*Rosa chinensis mutabilis*) has yellow flowers which change with age to orange, red and crimson.

Modern Hybrid Tea and Floribunda bedding roses are beautiful and desirable. I for one grow them with delight. But, if you grow them and nothing else—no climbers, no shrubs, no old-fashioned roses, no species or species hybrids—why then, you are living in such a *little* rose world—really!

Buhle

Shell-pink Hybrid Musk rose, PENELOPE.

The popular coral-pink Floribunda rose, Fashion.

Courtesy W. Tillotson

TRENDS IN MODERN ROSE BREEDING

The problems facing rose breeders and what may be expected in the new roses they produce

Dennison Morey

THE trends in plant materials that are of importance to the gardener are those differences of the new plants from the old that make them better garden subjects. The source of these trends must necessarily be new variations in the form of hybrids, sports, etc. of older materials, or new introductions from the wild and their subsequent hybrids, sports, etc.

The "etc." already mentioned twice would include such things as old varieties on new root-stocks and difficult new and old materials on better stocks.

Two primary factors are involved in the creation of trends. First, there is the evolution of new forms, and second, their introduction into the trade. In connection with the second point is a very potent force. This force is the pressure placed upon the trade to meet the requirements and expectations of the consumer. Those materials that are most apt to please the consumer are those that are always sought by the trade for introduction, and in the final analysis any and all trends are dictated by the consumer.

Requirements in New Roses

In roses this means that in order to be acceptable to the trade a new rose must not only have pretty flowers but lots of them, borne as continuously as growing conditions will allow and on plants that are hardy, disease- and pest-resistant, widely adaptable to garden conditions, and vigorous, and that are in and of themselves decorative. Moreover, the best in new roses are expected to look well even without much grooming and it may be readily observed that many of the new Floribundas and some of the new Hybrid Tea roses do not demand annual pruning in order to be an asset to one's garden. Both the ultimate consumer and the trade realize and appreciate the importance of minimum maintenance gardening.

Floribundas

Particularly noticeable is the popularity of the Floribundas, which are at present the only truly minimum maintenance roses. These roses are rapidly acquiring all of the esthetic qualities of the Hybrid Tea roses without losing the features of generally greater hardiness, disease and pest resistance, prolificness, continuity of bloom, wide adaptability to garden conditions, and vigor. And although the refinements of this group generally take the form of an increased resemblance of the flowers to the Hybrid Teas, the vegetative characteristics, prolificness and continuity of bloom which were and are the mark of these roses have been continuously enhanced.

It is to be expected and it may be observed in the newest Hybrid Tea roses that the virtues of the Floribunda, as far as they are consistent with the limits of the class, have become increasingly characteristic of the Hybrid Tea roses and climbers as well.

Certain future events can also be inferred from the nature and magnitude of the emphasis that various rose breeders are bringing to bear upon individual problems and deficiencies of garden roses, and which as yet are not always apparent at the garden level.

Four Basic Problems

There are four basic problems that are currently receiving the most attention. Most breeders, who must like everyone else take first things first, feel that disease resistance, prolificness and continuity of bloom, and vigor are three major problems at the moment. This does not mean that the other lesser problems have been forsaken. Quite the contrary is true, for in final analysis all rose problems impinge heavily upon these three, and moreover, the others receive special attention as well.

The fourth and biggest problem is developing universal adaptability to all garden conditions. This greatest problem facing the nurseryman and the hybridizer is not so much a function of the rose as it is the size of the United States with the attendant climatic and soil complexity. No botanist would expect to find one plant widely and completely distributed throughout the United States. It is virtually unknown in nature even among the hardiest, most virulent weeds. Yet the rose hybridizer is expected (or hopes) to produce a plant which will meet every soil and climatic situation within our national boundaries.

Fortunately, considerable success has been realized in solving this very difficult problem. There is a strong trend in roses produced in the United States in the direction of greater universality and broader adaptive responses to varied conditions. This is basically the result of American hybridizers concentrating on the more general and basic problems.

Interest in Species Roses

Lastly, there is at the present time a very active interest in species roses. This interest has waxed and waned in the past a number of times but never previously has there been enough real knowledge of rose cytogenetics to enable a rational and sustained species breeding program to be carried out.

There are therefore some very new and indefinable trends in modern rose hybrids that are not too perceptible as yet, except in isolated instances, resulting from the introduction of much new genetic material into garden roses. The results of this introgression must necessarily be vague at present, but it may certainly be expected that mildew, black spot, and rust-proof roses (of many kinds) are some of the ultimate results that are not too far away.

The trends in modern rose hybridization are in the direction of superior roses especially suitable to the living pace of the second half of the 20th century. The goal would seem to be a carefree garden always in flower during the entire growing season, a goal which if viewed from a point 30 years ago would seem already to have been achieved to a remarkable degree (in roses at least) and which is being pursued with greater and greater success each year.

ROSE GARDENS IN THE U.S.A.

(From the American Rose Society)

Each of the following rose gardens, open to the public, has a thousand or more plants in a range of varieties. Wherever possible it is advantageous for the enthusiastic amateur grower to make frequent visits to these gardens.

State	*City*	*Garden*	*Season*
Alabama	Birmingham	Avondale Rose Gardens	May-October
California	Berkeley	Berkeley Rose Garden	April-September
	Los Angeles	Exposition Park	Daily except 10 days during pruning
	Oakland	Oakland Municipal Rose Garden	
	Ontario	Charlotte Armstrong Memorial Rose Garden	Daily
	Sacramento	Municipal Rose Garden	Any time
	San Jose	San Jose Municipal Rose Garden	April-December
	San Marino	Huntington Library and Botanic Garden	Daily except Monday
	Santa Barbara	Santa Barbara Memorial Rose Garden	Any time
Colorado	Denver	Denver Arboretum and Rose Garden	May-October
	Pueblo	Mineral Palace Park	June-frost
Connecticut	Hartford	Elizabeth Park	Any time
	Norwich	Norwich Memorial Rose Garden	Any time
Delaware	Wilmington	Jasper Crane Rose Garden	Any time
Idaho	Boise	Municipal Rose Garden	Any time
	Caldwell	Caldwell Memorial Rose Garden	Any time
	Nampa	Nampa Lakeview Park	Any time
	North Lewiston	Lewiston Memorial Park Rose Garden	Any time
	Pocatello	Rotary Rose Garden	Daily
Illinois	Chicago	Washington Park Rose Garden	March-October
	Highland Park	Highland Park Memorial Rose Garden	March-September
Indiana	Fort Wayne	Lakeside Rose Garden	June-September
Iowa	Davenport	Municipal Rose Garden	Any time
	Des Moines	Greenwood Park Rose Garden	April 15-October 1
Kansas	Topeka	Reinisch Rose Garden	Any time
Michigan	East Lansing	Michigan State College	June-September
	Lansing	Cooley Gardens	May 1-November 1
Minnesota	Minneapolis	Minneapolis Municipal Rose Garden	June-October
Missouri	Independence	Glendale Rose Garden	May 21-November 1
	Kansas City	Rose Garden	April-November
	St. Louis	Jewel Box Rose Garden	
Montana	Missoula	Missoula Memorial Rose Garden	Blooming season
Nebraska	Lincoln	City of Lincoln Municipal Rose Garden	Any time
New York	Bronx Park	New York Botanical Garden	Any time
	Brooklyn	Brooklyn Botanic Garden	June-November

State	*City*	*Garden*	*Season*
New York	Buffalo	Niagara Frontier Trail Rose Garden	Any time
	Farmingdale	Long Island Agricultural and Technical Institute	Any time
	Flushing	Rose Garden at Queens Botanical Gardens	June-October
	Ithaca	Cornell University Test Garden	Any time
	Middletown	State Hospital Rose Garden	
	Newark	Jackson & Perkins Company Rose Garden	June 15-November 15
	Rochester	Municipal Rose Garden	May-October
	Syracuse	Dr. E. M. Mitts Rose Garden	June-November
North Carolina	Charlotte	Sunnyside Rose Garden	May-November
Ohio	Barberton	J. E. White Nursery	Any time
	Bay Village	City of Bay Village	All summer
	Columbus	Columbus Park of Roses	June-October 15
	Mentor	Paul R. Bosley Nursery	June-frost
	Mentor	Joseph J. Kern Rose Nursery	June-October
Oklahoma	Oklahoma City	Municipal Rose Garden, Will Rogers Park	
	Woodward	Woodward Rose Garden	Any time
Oregon	Portland	International Rose Test Gardens	May-December
Pennsylvania	Allentown	Malcolm W. Gross Memorial Rose Garden	Any time
	Harrisburg	Breeze Hill Gardens	April-December
	Harrisburg	Municipal Rose Garden	June-September
	Hershey	Hershey Rose Gardens	May 1-November 1
	Kennett Square	Longwood Gardens	Any time
	Philadelphia	Mellon Park Rose Gardens	Any time
	Pottstown	Pottstown Municipal Rose Garden	Any time
	Reading	Municipal Rose Garden, City Park	June 1-November 1
	State College	University Park, the Pennsylvania State University Rose Garden	June 10-October 1
Rhode Island	Little Compton	Brownell Rose Research Gardens	Any time
South Carolina	Orangeburg	Edisto Gardens	Any time
Texas	Amarillo	Memorial Park Rose Garden	Any time
	Fort Worth	Rotary Park Botanic Gardens	All year
	Tyler	A R P Roses, Inc.	May-frost
	Tyler	Tyler Rose Park, Municipal Rose Garden	Any time
Utah	Provo	Provo Memorial Rose Garden	Spring-Fall
	Tooele	Tooele City Municipal Rose Garden	Any time
Virginia	Norfolk	Lafayette Park Municipal Rose Garden	Any time
Washington	Aberdeen	E. C. Miller Memorial Rose Garden	Any time
	Tacoma	Tacoma Municipal Rose Garden	Any time
West Virginia	Huntington	Ritter Park Rose Garden	Any time
Wisconsin	Hales Corners	Whitnall Park Botanical Gardens	Any time

Gardening off the ground in the Rose Garden.

THE CRANFORD MEMORIAL ROSE GARDEN

At the Brooklyn Botanic Garden

One of the loveliest and most popular of the Brooklyn Botanic Garden's "many gardens within a garden" is the Rose Garden. It was established through the generosity and interest of Mrs. Walter V. Cranford and the late Mr. Cranford. Construction was begun and completed in 1927, the first bushes being planted in November of that year. The opening to the public was made the following spring. In 1935, after Mr. Cranford's death, Mrs. Cranford gave the Rose Arc and pool, just south of the rose garden proper, in his memory.

The Grounds

The Cranford Memorial Rose Garden occupies an acre of ground, and considering the value of the land (which belongs to the City of New York) and the gifts of the Cranfords, there is a financial outlay of well over a quarter of a million dollars. The "interest" on this substantial investment is in beauty—a wealth of color, form, and fragrance—which is shared freely by any and all visitors to the garden.

The Collection

The rose collection in the garden at present numbers over 4,000 plants of some 600 species and varieties. Practically all types of roses are represented, including a great many old favorites. The side borders of the garden contain 257 different species roses and species rose hybrids; 107 different varieties of climbers cover the enclosing fences and arbors. And in the central beds are 238 varieties of Hybrid Tea roses, an extensive collection of Hybrid Perpetuals, and many Polyanthas, Hybrid Polyanthas, and Floribundas. Among the old-fashioned roses are Bourbons, Chinas, Mosses, and Noisettes; Teas and Grandifloras are also represented.

Testing of new roses is done in collaboration with some of the interested nursery firms.

Two sections of particular interest are the terrace at the south end of the garden, which shows the type of planting which might be used in a small home rose garden; and the terracing of a bank at the foot of the overlook to the north. On this bank *Rosa wichuraiana*, *R. setigera*, Floribundas, and Hybrid Teas have been planted to serve both utilitarian and decorative ends. Cut logs help hold the terraced soil.

Not content with having established this magnificent garden, in 1952—its 25th anniversary year—Mrs. Cranford, assisted by her daughter Margaret, started to build an Endowment Fund for the Rose Garden. In so doing they have taken steps toward ensuring that it will continue for as long as the Brooklyn Botanic Garden exists to bring pleasure and knowledge concerning roses to all who visit it—from many states and foreign countries—as well as from the greater New York area, home of one out of every 16 people in the United States.

P. K. N.

Faithful member of the Brooklyn Botanic Garden staff for more than 40 years, John Juzwick has worked in the Rose Garden since its beginning. ↓

Buhle photos

Gardener-in-charge, George Carle, prunes climbing roses. ↑

ROSES IN THE SOUTH

How to overcome the difficulties of soil and climate and grow roses to perfection below the Mason-Dixon line

Ralph M. Dasher

THERE are those who picture the South as a land of magnolias, honeysuckle, and beautiful girls; and, of late also a land of revived craze for azaleas and camellias. It is true that the South has all of these—and more, but it is equally true that the rose stands out as the best-loved flower, from the lowliest backwoods shack to the most magnificent of mansions.

The Region

Generally speaking, the South is that section below the Mason-Dixon line which extends southward and westward to Texas. Oklahoma, West Virginia, Missouri, Arkansas, and most of Texas are more properly regarded as fringe areas or border states, possessing only a few of the characteristics deemed typical of "The South." Even Maryland might be so regarded.

The remaining area may be divided into three sections—the Lower, Middle, and Upper South. There is, of course, considerable overlapping of soil type and climate between adjacent sections, and the portion of Florida southward from the middle of the state is a special exception, being essentially tropical in climate.

Climate

The average annual rainfall over most of the South is 40 to 60 inches, and a part of the western Gulf Coast receives between 60 and 80 inches, as do a few spots in southern Florida. The Upper South has an average annual temperature of between 50° and 60°F., most of the Middle and Lower South averages 60° to 70°, and lower Florida from 70° upward. All sections have recorded 100° plus in midsummer, and even the Middle South may be chilled in winter by sudden drops below zero, of brief but damaging duration. In recent years, killing frosts or freezes have extended to the Gulf and into Florida. The exceptional severe freezes or prolonged drouths tend to be all the more damaging because of their comparative rarity and the consequent lack of preparation to combat either.

Soil

Soils along the South Atlantic Coast, throughout Florida, and in some parts of the Gulf Coast are infertile sands, very rapid in drainage; a portion of the Gulf Coast has generally fertile soil which drains poorly; the greater part of the South has moderately fertile yellowish and reddish soils, ranging from sands to heavy clays; and, extending like a boot through Kentucky, Tennessee, and into northern Alabama, is a narrow strip of infertile sandy to stony soil of the Appalachian Plateau.

Culture of roses under these varying conditions of soil, temperature, and rainfall may be illustrated by the procedures followed at three test gardens maintained by All-America Rose Selections, Inc.

Culture in Sandy Soil

The soil at the Gainesville, Florida, garden is a porous sand, infertile, lacking in organic matter, which drains very rapidly. New plants are set out in late

December or early January, in beds prepared by mixing organic materials with the native sand, and the blooming season is long, frequently from February into the next winter. Horticulturists in charge have found it feasible to feed these plants one pound of 5-10-5 plant food, with minor elements added, to 100 square feet of bed surface each week! Rainfall is heavy and irrigation seldom is needed but is used when necessary. Observers report that leaching is so rapid that nutrient deficiency symptoms frequently appear when the time between feedings is lengthened. Such heavy feeding would injure roses in heavier soils, but at Gainesville, plants grow steadily throughout the season and first-year growth may reach to 6 or 7 feet.

Culture in Heavy Soil

The soil of the garden at Lafayette, Louisiana, similar to that which lies along the Gulf westward from New Orleans into Texas, is black, very heavy, and overlies a high water table. Plants set out by normal methods usually survive a season, perhaps two, before dying or becoming so poor as to require replacing. The experts at Southwestern Louisiana Institute have found that roses should be "planted like people." (Most graves in that area are above the usual soil level.) Organics and soil are brought in and built up to a height of about 2 feet more than the surrounding earth; no attempt is made to spread rose roots downward over a mound but they are planted in an almost horizontal position; the extra soil then is heaped over the plant base and a mulch of bagasse (sugar cane pulp) applied to a depth of several inches. Feeding is normal and rainfall is usually adequate to excessive; on occasion, rose mounds must be reinforced to prevent washing. Here, as in Florida, first-year growth of roses results in large plants, and roses so planted apparently are long-lived, equal to those anywhere.

Culture in Sandy Clay

A third AARS test garden, at Thomasville, Georgia, almost as far south as Gainesville, follows the accustomed cultural practices as regards soil preparation, planting, feeding, etc., and achieves excellent results in a soil consisting of a sandy clay.

McFarland

Cherokee rose (*Rosa laevigata*) is usually white, occasionally rose.

The point is that each of the three sites must employ vastly different methods to insure success and an apparently normal custom at one would be abnormal at the others. Fortunately, such radical departures from the norm are not required over most of the South and minor modifications suffice.

Winter Care and Pruning

In most cases, bud unions are set at or above the surrounding soil, hilling or other winter protection is almost unknown and, where used, may do more harm than good. Excepting after the unusual one-in-ten winter which brings old-wood-killing temperatures, pruning is performed to shape or keep plants in bounds or to encourage new basal breaks, rather than from necessity or through a mistaken idea that larger and better blooms may be produced from a low-pruned plant. These practices are modified, naturally, as one goes further north or into more severe conditions but, even in the Upper South, one finds most gardeners inclined to use a moderate approach.

Experience in Florida

In Florida, roses were treated as annuals until recently. One reason was that many rosarians emigrated from northern states and attempted to use cultural practices similar to those used in other climes. Mrs. G. F. Lampkin, Bradenton, and others have experimented since and found that roses will thrive for years if one adds sufficient humus, does not amputate the plants when pruning, and uses common sense in supplying moisture, food, and protection from diseases. Although some varieties sulk, most of the modern varieties with high national ratings perform well, as do many of the older kinds—Hybrid Teas, Teas, species roses, and others.

Kinds That Can Be Grown

The Lower South and much of the Middle South enjoy conditions conducive to growing well such tender roses as the Banks roses (*Rosa banksiae*) which will climb as high as a house, water tower, or large tree and be adorned in spring with small, slightly fragrant, yellow or white blooms in large clusters and be dressed in evergreen foliage on thornless stems the year around. *Rosa bracteata,* the Macartney rose; *R. laevigata,* much better known as the Cherokee; the Noisettes, the most noted of which is Maréchal Niel, famed for its fragrance and yellow color; the Chinas; and many species and hybrids which are too tender for more vigorous climes abound in all their glory to delight winter visitors while snow and ice cover the northern states. In many places, the Cherokees and Banks roses have become naturalized and add to the beauty of the landscape.

Varieties of recent origin are grown successfully in all parts of the South. We are no more limited to a few older varieties or to those with tender characteristics than are rosarians in northern sections forced to grow only hardy species or Hybrid Perpetuals or the old-fashioned but hardier roses of yesterday. As a matter of fact, it is possible to have the hardy varieties in the South also, even along the Gulf Coast, along with Teas, Noisettes, and others. Increasingly, however, as in other sections, more gardeners are finding satisfaction with Hybrid Teas, Floribundas, and the new but outstanding Grandifloras, with their modern colors and shapes and sizes.

Hybrid Tea Roses Which Have Found Favor in the South

Charlotte Armstrong	red to cerise
Christopher Stone	scarlet overlaid with crimson
Countess Vandal	inside salmon-pink, reverse coppery-pink
Crimson Glory	deep, velvety crimson
Dainty Bess	soft rose-pink
Eclipse	golden-yellow
Editor McFarland	glowing pink, slightly suffused with yellow
Etoile De Hollande	bright red
Kaiserin Auguste Viktoria	snowy white, slight lemon tint at center
Mme. Cochet-Cochet	coppery rose-pink, tinted coral
Mme. Henri Guillot	orange-coral-red
Mrs. Charles Bell	shell-pink, shaded soft salmon
Peace	lemon-yellow edged with pink
Picture	clear rose-pink
Red Radiance	light crimson

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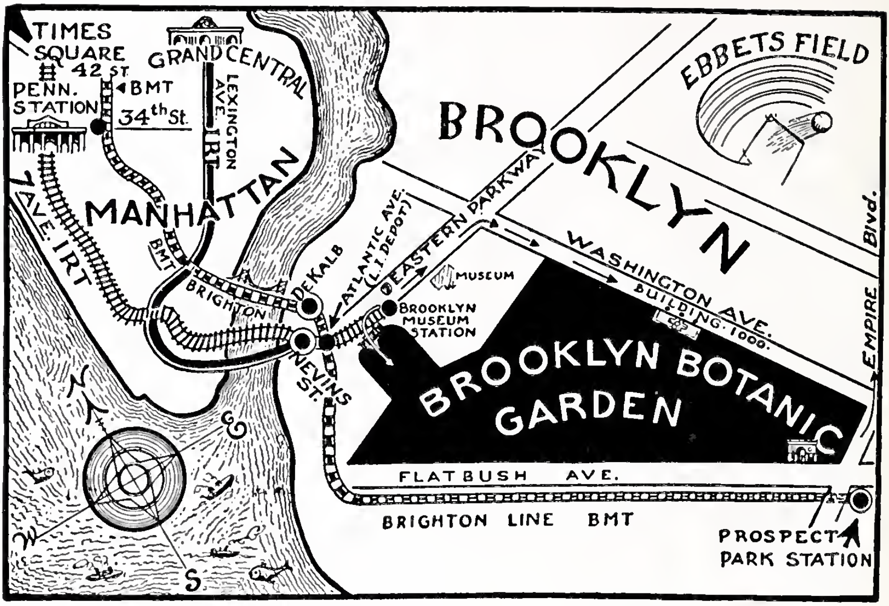

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BROOKLYN BOTANIC GARDEN RECORD

PLANTS & GARDENS

FLOWER
RRANGEMENT

Design
and Color

Interpretive
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Arrangements

Making
Containers

Drying and
Pressing
Flowers

Corsages

Christmas
Decorations

Miniatures

AUTUMN
1955

NEW SERIES
OL. 11 No. 3

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PLANTS & GARDENS

VOL. 11 Autumn 1955 No. 3

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Except where otherwise credited, drawings by Peter K. Nelson

Editorial

MARION FEDDERSEN, *Guest Editor*

PETER K. NELSON, *Associate Editor*

and the Editorial Committee of the Brooklyn Botanic Garden

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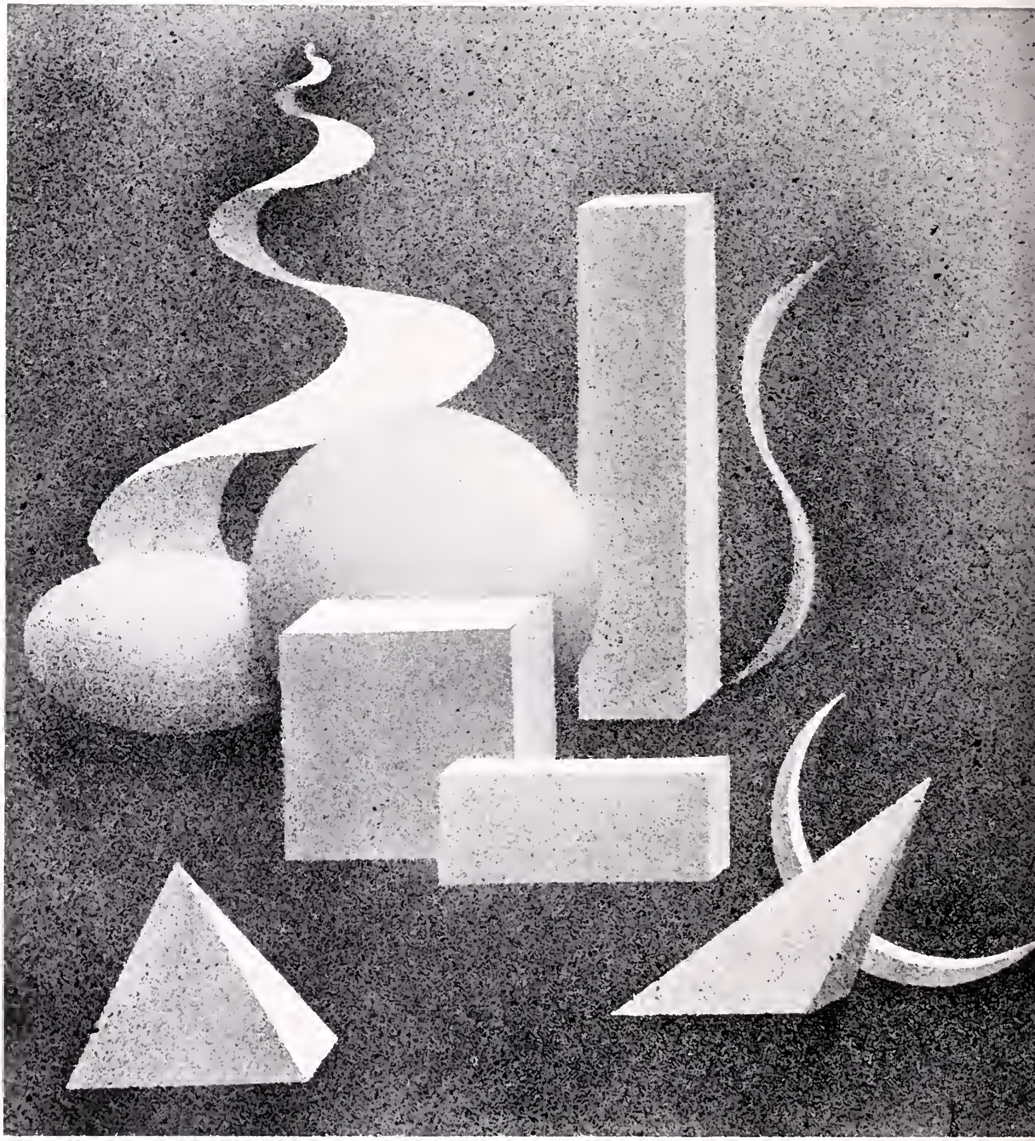


The basic figures governing the design of flower arrangements are to be found in a few forms of solid geometry.

THE BROOKLYN INSTITUTE OF ARTS AND SCIENCES
BROOKLYN BOTANIC GARDEN
1000 WASHINGTON AVENUE
BROOKLYN 25, NEW YORK
TELEPHONE: MAIN 2-4433

Autumn 1955

This issue of PLANTS & GARDENS is directed chiefly to women, whose interest and natural skill in flower arrangements — in America, at least — far surpass that of men.

In Anne Morrow Lindbergh's GIFT FROM THE SEA, she writes of the importance of one's having time alone for contemplation, study, or work. In such times she urges a creative undertaking, though it need not be an impressive project or great work. Rather, "it should be something of one's own. Arranging a bowl of flowers in the morning," she says, "can give a sense of quiet in a crowded day — like writing a poem, or saying a prayer."

What a beautiful thought! I would like to believe that everyone who arranges flowers has that sensitive creative feeling which can so greatly enrich one's living — particularly those who work with natural things, so assembling them that new and added beauty emerges from the whole.

Turning from fleeting thoughts to the more tangible, our editorial committee feels that Editor Fedderson and her authors have done an impressive job. They've given the necessary theory along with specific simple how-to-do-it directions. They haven't lost sight of the fact that this must be an inspirational book too.

Some phases of flower arranging have special appeal for children, so give them the plant materials and a two or three word directive such as "make animals." Natural creative ability will take care of things from there on.

But child or adult, if one lends a sympathetic eye to the pages of this special handbook, added knowledge and skill will bring new rewards to the inner self, and perhaps a few blue ribbons to satisfy the competitive urge.

Sincerely yours,

George S. Avery, jr.

Director

DESIGN IN FLOWER ARRANGEMENT

Basic principles and how to apply them

Esther Wheeler

IN a fine sense, flower arrangement is one of the creative arts, and unquestionably it is an art of selection and composition. It certainly does not depend upon the dexterity of the hand, or on skill in craftmanship for its success, but rather on the skill of selection and arrangement. To effect work of a high standard and to be outstanding as an arranger, power of imagination and of artistic synthesis are most necessary.

One must have an unerring sense of (1) just what is appropriate, (2) a clear conception of what is harmonious and beautiful relative to form and color, and (3) a considerable familiarity with plant material. A flower arranger must be able to choose from the available supplies those things which possess fitness and beauty, and then have the ability to combine and arrange them to get a harmonious picture. This process of combination is called composition. Frankly, it requires precisely that complex of appreciation, discrimination, judgment, and knowledge connoted by the words "good taste."

As poetry combines words into phrases, lines, and stanzas so that each word and phrase helps the others, so it is with "painting pictures with flowers." Everything helps everything else. The four basic elements of good design—proportion, structure, movement, and beauty of line—must be maintained. With these four elements in mind, one takes lines, forms, colors, and textures, and arranges them into a given space so that each is helpful to the other. The harmony of the whole will vary according to individual tastes and temperaments.

Nature the Source of Ideas

A flower arranger's greatest source of inspiration is nature. Nature has unlimited and inexhaustible form and design from which to draw, and it is from these forms and designs that original ideas are formulated. The arranger also learns from nature the rhythm of movement and grace of line, which are so necessary to make a pleasing arrangement. While it is true that one must have balance, good proportion, strong structural lines, and an interesting silhouette, it is the rhythmic line which expresses beauty in the finished design.

Rhythm

Why is rhythm considered an essential principle in the creation of a design? It is because it expresses "living growth" and a flower arrangement to be really good, must seem "alive."

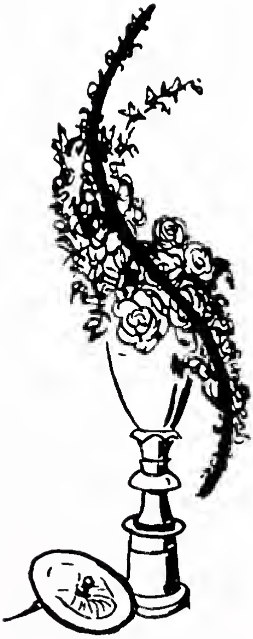
Line is in itself a mathematical abstraction, but when used by a flower arrangement artist, it is an imaginary axis to some extent and its power is indisputable. Line conveys or communicates action and life. It denotes expression through definite positions, and a line, imaginary or real in a flower composition, has a power to call into consciousness, to a greater or lesser degree, certain emotions. For example, one associates straight lines with strength and force, and curved lines with ideas of flexibility, buoyancy, and grace. Horizontal lines express calmness and repose, or activity and support. Straight lines can only vary in length and are least ornamental, while curved lines, as they vary in degrees of curvature as well as length, begin on that account to be ornamental.

ILLUSTRATIVE EXAMPLES

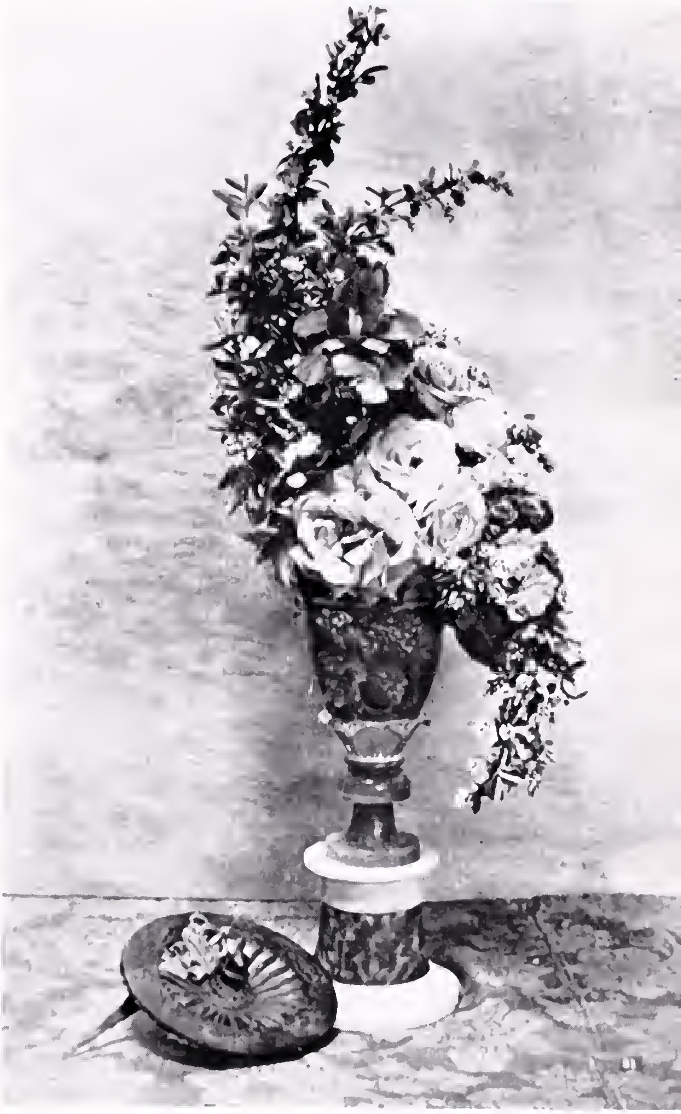
The photographs show eleven types of lines as used in actual flower arrangements. So short an article cannot teach the whole of design in flower arrangement—it can but point the way toward understanding it.

Flowing S-curve or Hogarth's line of beauty suggests powerful and graceful movement; one of the most beautiful forms in flower arrangement.

Garden flowers in alabaster urn.

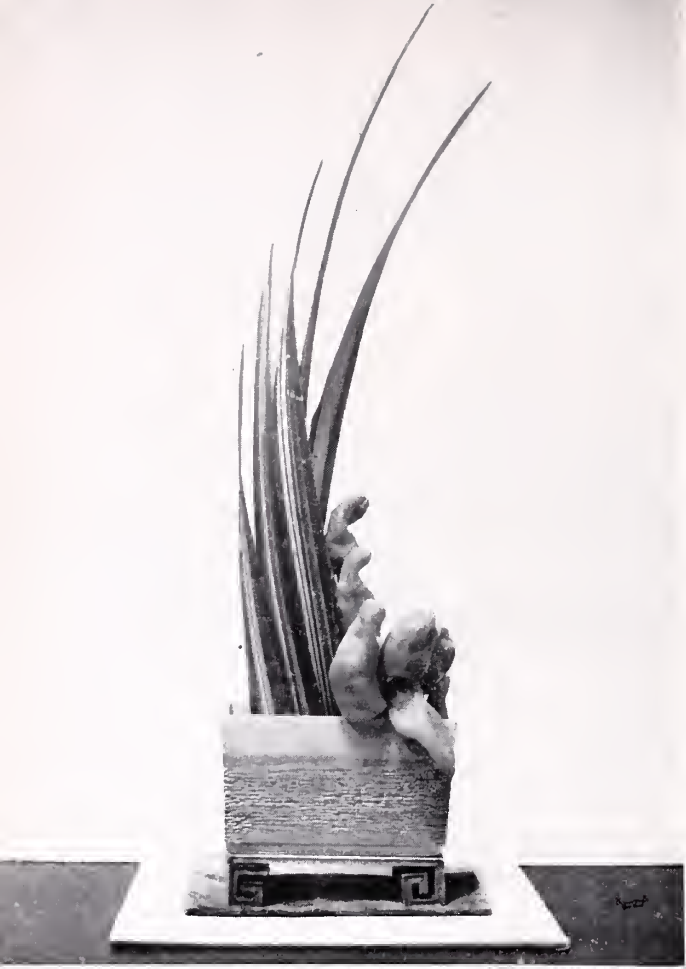


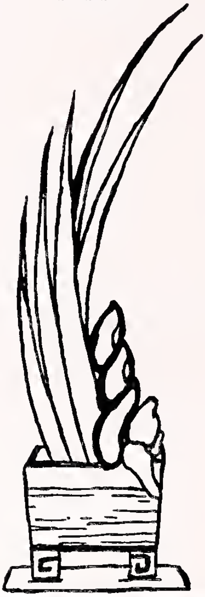
Arranged by Esther Wheeler *Boutrelle-Sevecke*



Spiral—a rhythmic line often found in nature; examples: scales of pine cones, tendrils of vines, sea shells.

Pandanus leaves and green peppers.





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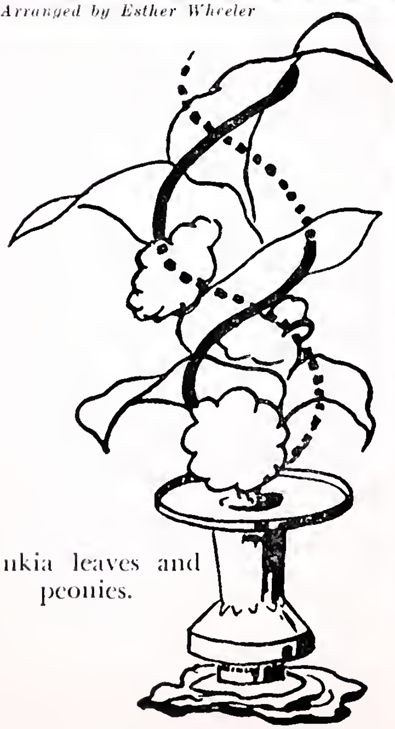
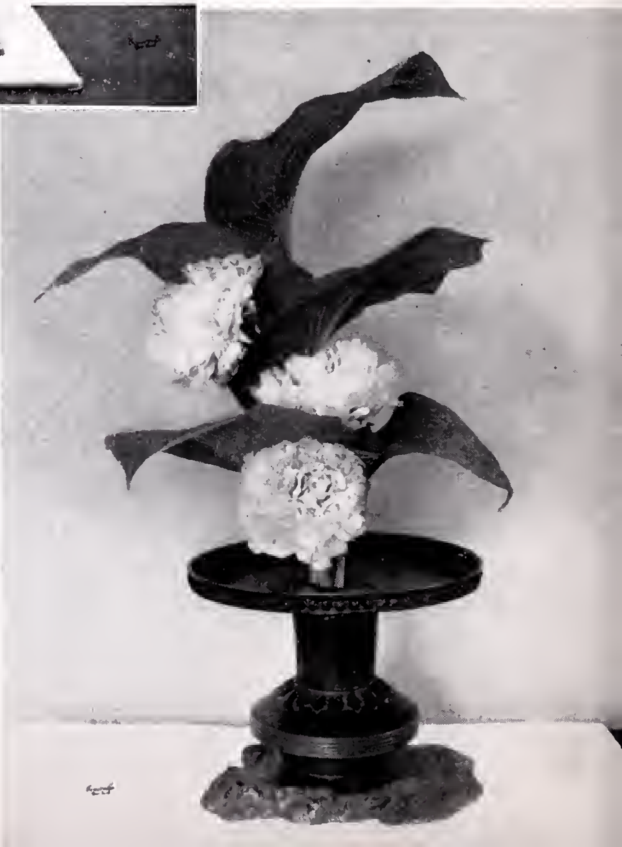
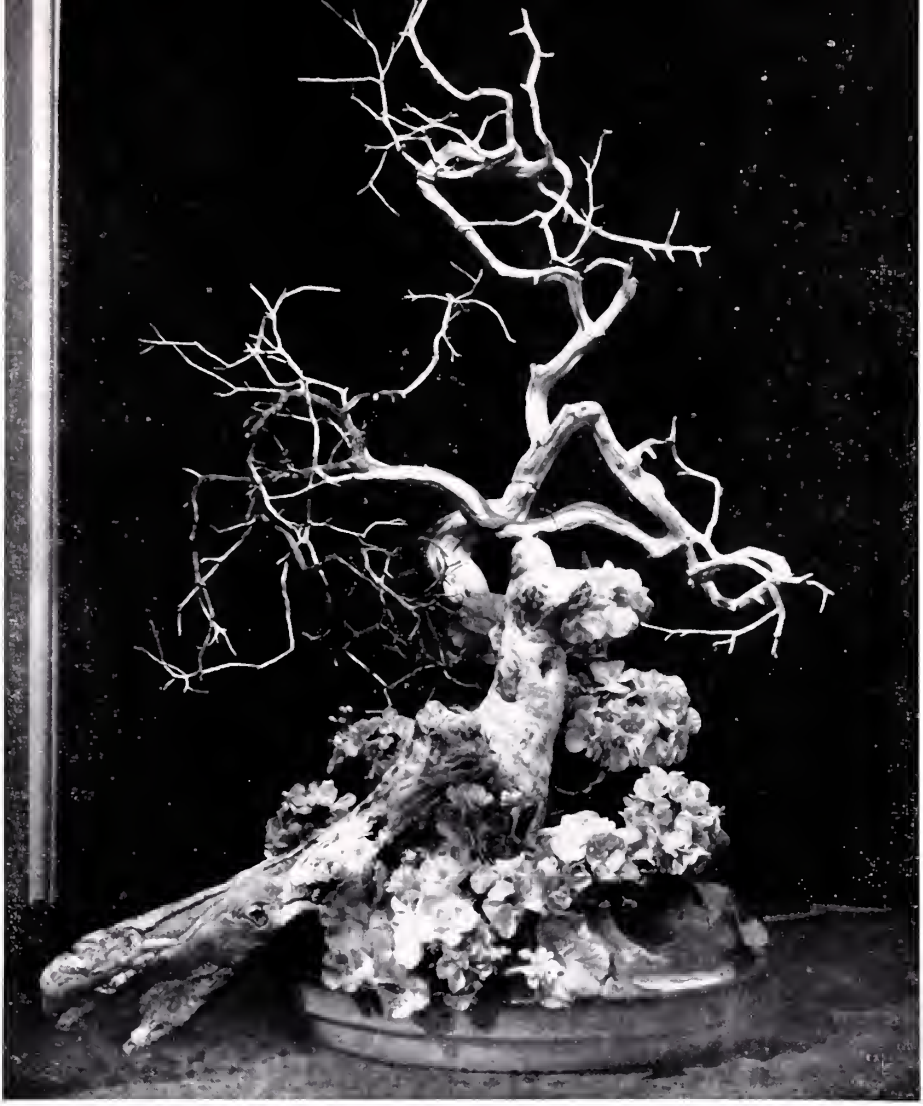
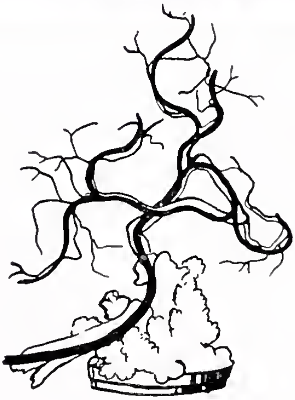


Funkia leaves and peonies.



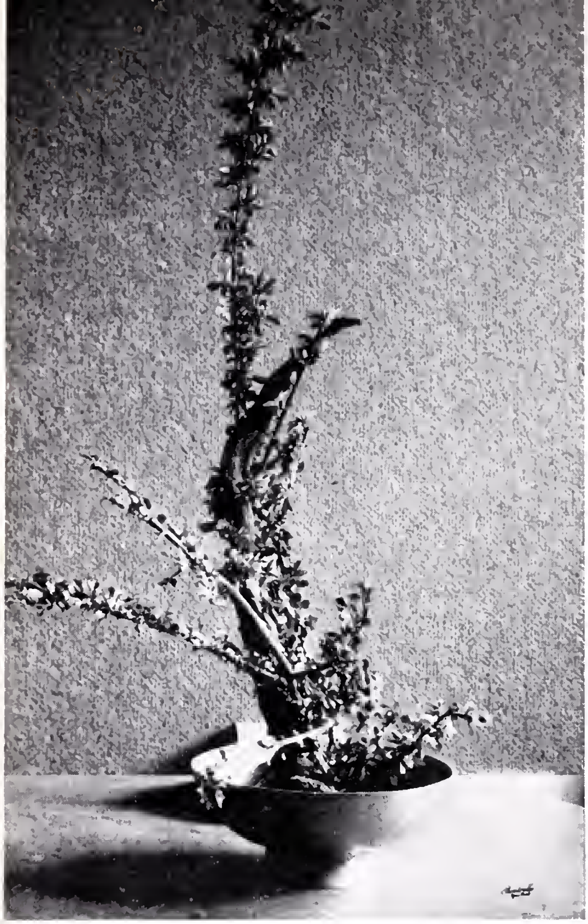


Arranged by Esther Wheeler *Boutrelle-Sevecke photos*



Swirl—a dramatic rhythmic line suggesting the swish of water or the spectacle of fire.

Vivid red geraniums with manzanita (*Arctostaphylos*).



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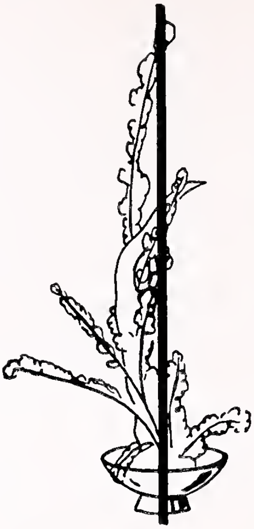
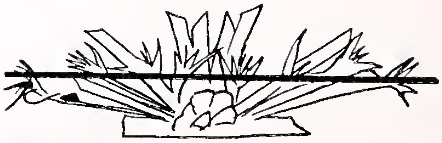


Vertical line shows perfect balance and can become majestic and austere when carried to higher levels; has dignity and solemnity, yet is easy for the amateur to use.

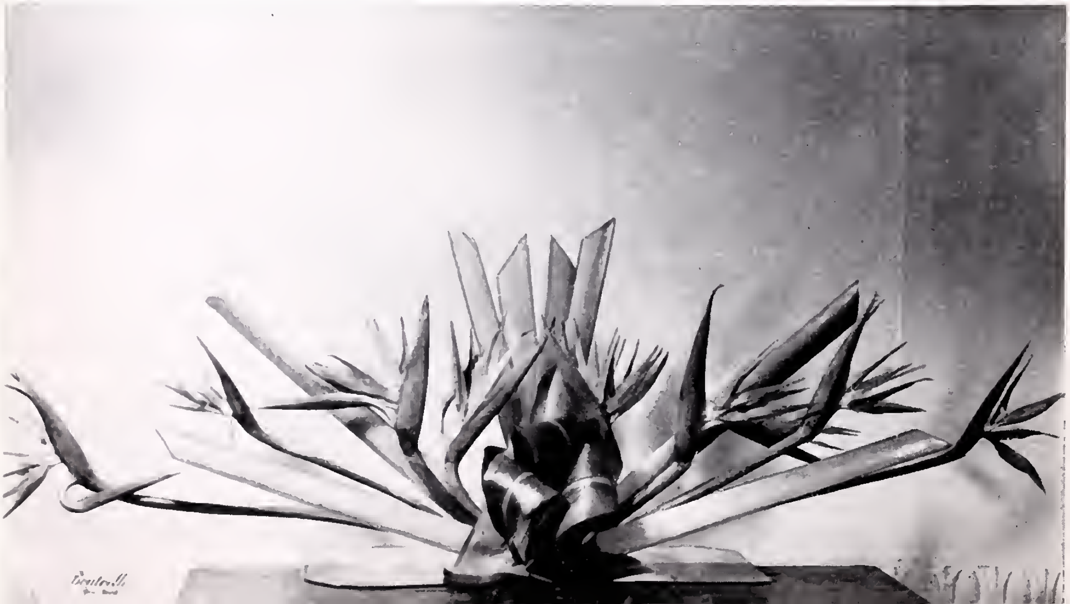
Berberis julianae in Chinese pewter bowl.

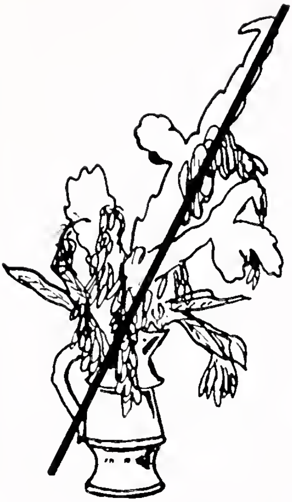


Horizontal line suggests calm, repose, and finality. Bird-of-Paradise flower and sugar cane.

Arranged by J. G. Conway

Boutrelle-Serecke photos



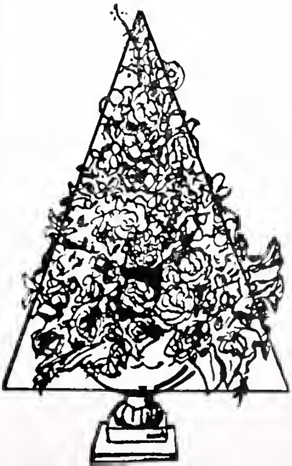


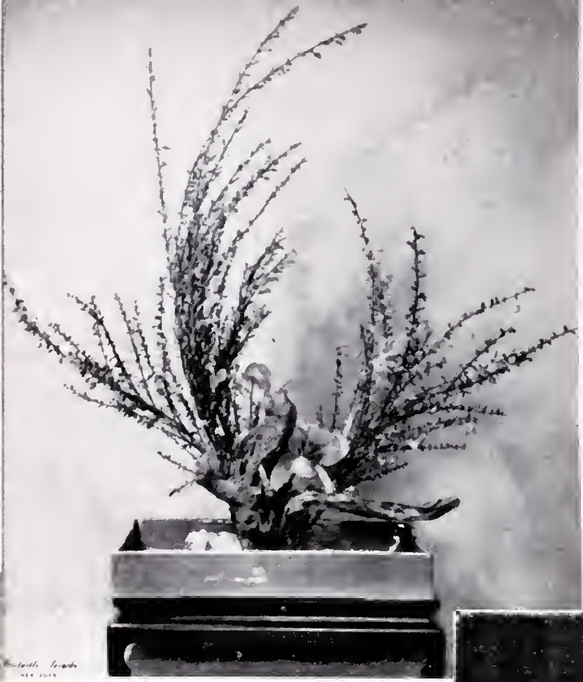
Diagonal line is off balance and therefore indicates movement; in flower arrangement balance should be restored by center of interest or other support. Cactus and honeysuckle.

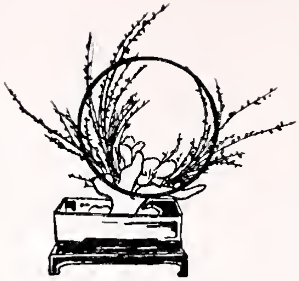
Arranged by Esther Wheeler *SEAF Camera News*

Arranged by Mrs. Ralph Ferd *Boutrelle-Sevecke*

Pyramid suggests dignity and stability; it is the form of perfect balance. Much used for mass arrangements but unless there is a suggestion of uneven spaces the form becomes monotonous. Garden flowers in alabastar urn.



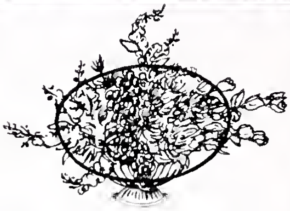




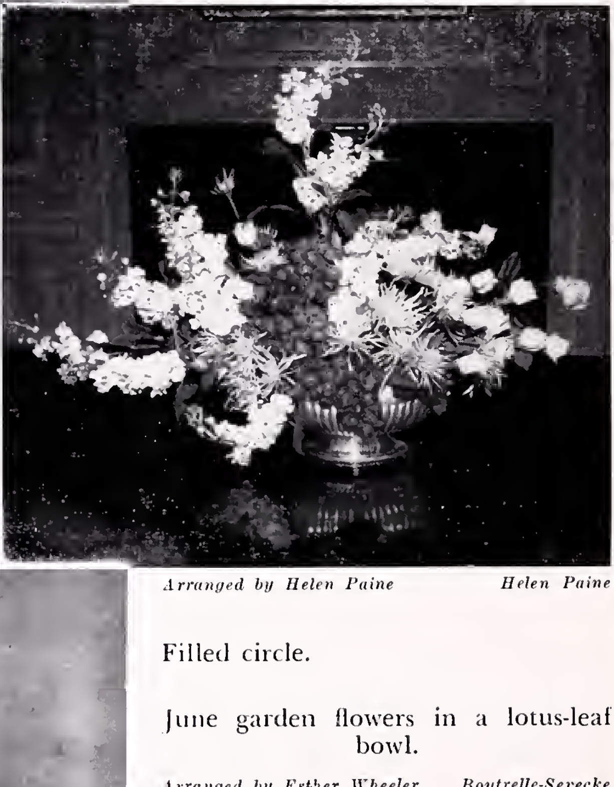
Open circle is balanced rhythmic line.

Flowering Scotch broom (*Cytisus scoparius*) and tulips.

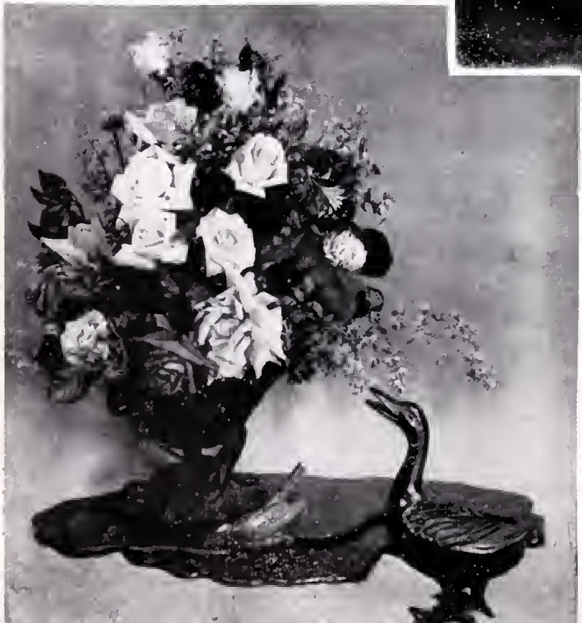
Boutrelle-Sevecke



Oval — a simple form but with greater variety than circle.
White roses and stock (*Mathiola*), green Fuji chrysanthemums, and green grapes.



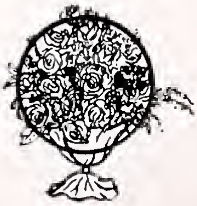
Arranged by Helen Paine *Helen Paine*

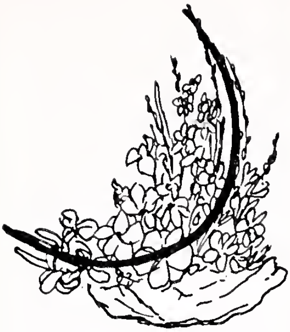


Filled circle.

June garden flowers in a lotus-leaf bowl.

Arranged by Esther Wheeler *Boutrelle-Sevecke*

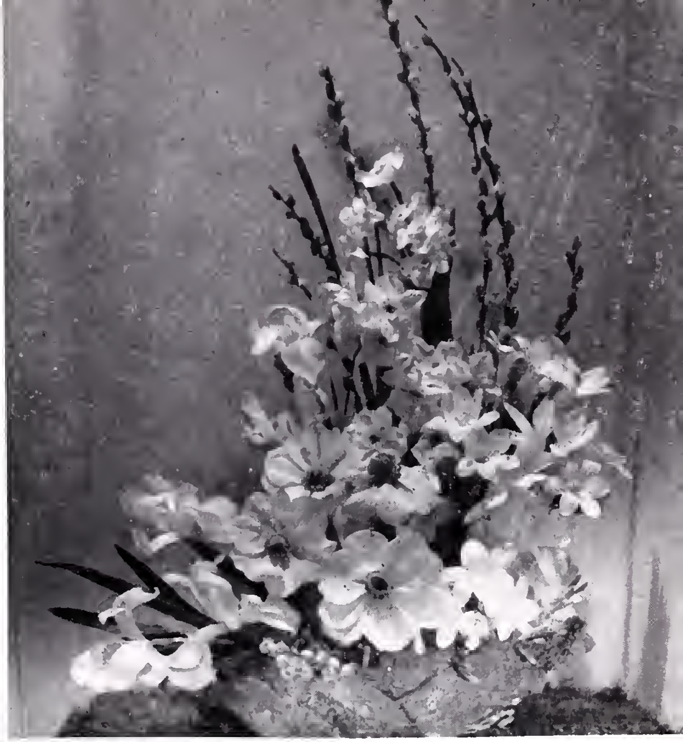


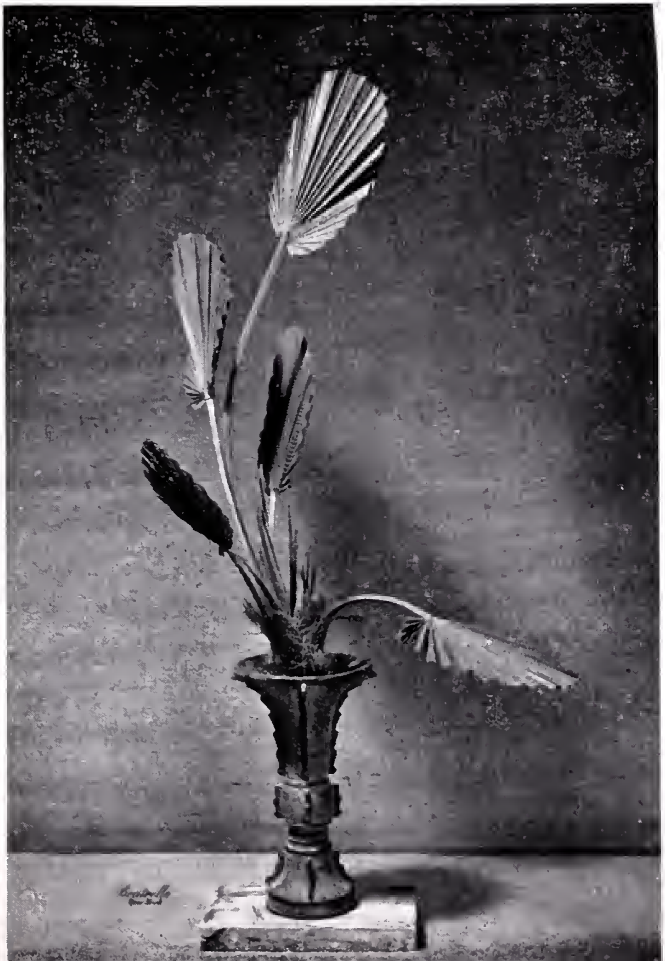


Crescent suggests slow rhythmic movement and has become the most popular form in American flower arrangement today.

Spring flowers.

Arranged by Mrs. W. B. Clark

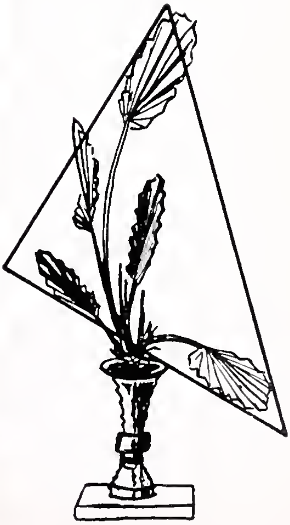




Asymmetrical triangle as developed by the Japanese has good proportion, balance, rhythm, and stability; natural growth of plant material is never distorted.

Cut palmettos.

Arranged by Esther Wheeler
Boutrelle-Sevecke photos



HOW TO USE COLOR

More beautiful flower arrangements can be achieved by application of the basic rules of color harmony

Grace Lincoln

FLOWER arrangement is the art of composing a picture with natural form and color. Unlike the painter who may create his forms in any proportion he chooses and mix his pigment colors in any dimension he finds most expressive, the flower arranger selects material as it appears in seasonal production. Frequently there are limitations which have to be compensated for and reliance must then be placed upon a few fundamental color facts for a path to a sucessful solution.

Color Families

Most important is the ability to recognize color accurately, and this comes through observation and practice. Color is the area identification of form, depending upon light in its variable quality for its success in combinations. The primary colors of red, yellow, and blue, with their secondaries, orange, green, and purple, provide the individual family color groups which exist in our world of color in natural plant forms. Within each family there are many identifiable hues derived from the same dominant source, and these produce a harmony of likeness which is of value in planning the color scheme. Hue differences in the family of red, for example, range from purple-red in one instance, to orange-red in another.

Dimensions of Color

Next we discover that any specific piece of color may be described through three dimensions. Why should we be immediately concerned with these dimensions of color? They are important because they supply the key to color balance and proportion in selecting. Any arrangement of plant material must conform to certain design principles in the organization of its proportions, and any piece of color has its own measure of attractive force which must be scaled to create harmony and a sense of motion through easy gradations.

The dimensions of color are **hue**, **value**, and **intensity**. Think of **hue** as the name of a color, explaining its particular character or personality; red-orange and yellow-orange are hues of the orange family group but with a visible difference. (Orange is itself a hue, as are red, green, blue, etc.)

Value is the relative lightness (toward white), or darkness (toward black), of any hue. There are many steps between black and white, and many "pink" flowers are some light value of red. Brown is usually a dark value of orange, while "peach" is a light value of the same hue (orange). Study the differences in hue value, because any flower arrangement should have well balanced light and dark proportions in the finished design.

The third dimension, **intensity** (also called **chroma**) describes the purity and intensity of a hue or its degree of neutralization (grayness). The spectrum supplies an example of colors which have maximum intensity, or the ability to be as full of color as possible. Black, white, and the grays are neutral or hueless additions to color design, which do not compete with the chromatic scale if they are properly adjusted in proportion.

Color Wheel

The next step in designing color in flower arrangements is supplied in the service rendered by any standard color wheel. However, the average flower arranger will gain some useful experience by making a simple chart. A sheet of white paper or a square of white cardboard is the first requirement. On it a circle about 6½ inches in diameter is drawn. Along the inner edge of this circle are put twelve circles 1¼ inches in diameter. These are to be spaced at equal distances apart. Any Woolworth store or artist's supply shop can supply a No. 16 box of Crayola crayons. These crayons are as nearly representative of the chromatic quality of the spectrum hues as any pigment form can be. The collection holds red, red-orange, orange, yellow-orange, yellow, yellow-green, green, blue-green, blue, blue-violet, violet, and red-violet. In the succession listed above, which is the way they appear in the spectrum, the twelve hues are filled into the twelve circles, clockwise, using red at 12 o'clock, red-orange at 1 o'clock, and so on. This will produce a useful chart or hue circuit. (See pattern on page 191.)

It will be found that flowers conform approximately to the colors in the chart but, in addition, they will sometimes be lighter or darker in tone. In selecting foliage forms you will discover many that are not green; for example, the multi-colored leaves of varieties of coleus and Rex begonia, or the pale gray foliage of woolly betony (*Stachys lanata*) and *Artemisia* SILVER KING. You will also observe that there is no green which looks like the "green" used in the chart, but that is because the green in most plant forms has a lot of yellow in it, while some of the greens are blue-green. In eight varieties of *Hosta*, the foliage ranges from a very light yellow-green, through greens that have less yellow and are darker, to blue-green which is grayed.

Three Basic Color Plans

There are three basic color plans for flower arrangement or any use of color. There are plans based upon the use of one color and a selection of its values. These are called **monochromatic** color plans and are generally used to illustrate the beauty of value gradations.

Another plan is called a selection of **analogous hues**. It illustrates the harmony of hues which are closely related on the hue circuit. The hues subtly blend, and three adjacent hues generally provide sufficient color interest.

The third plan, **complementary**, is based on the idea of contrasting hues which accentuate one another's qualities by their unlikeness. The colors are dramatic and each complements or completes the other, and together they prove a harmony of contrasting qualities.

The value of a color wheel is confirmed through the ease with which anyone can set up a successful color selection by choosing any one hue with its value gradations (monochromatic), or by choosing the hues which are found in any one-quarter segment of the wheel as they appear in succession (analogous), or by choosing hues which are found opposite each other on the wheel (complementary), as straight complements, or some variation of the use of contrast. One of the most beautiful color schemes is a set of straight complements with two hues which are analogous to one of the complements.

An Example

In planning some complementary schemes, one has to remember that the green of foliage is a natural part of the plant and it is wise to plan to include some green in a valid selection, or to find foliage in a color which can be within the limits of hues to be used. In one case, a Chinese porcelain vase was a brilliant apple-green, so called, and quite like the green in the spectrum. Obviously, a contrast was a possible solution for an arrangement in this vase, and two handsome stalks of red-purple gladiolus solved the plan. One stalk was a lighter value than the other and each had light and darker value gradations in the color effect. Foliage used was coleus, which had a stripe of the red-purple down the center of each leaf, with a wider border of very dark green and a thin line of very light green along the edge.

Using Bronze

Color is where a seeing eye finds it. A container will sometimes suggest a color plan. Bronze is a fairly dark metal and some very successful designs have been worked out by using the harmonious browns of dried Siberian iris (*Iris sibirica*) seed pods and stems, to create a background of primary structure keyed to the color and texture of a bronze "usubata" (a vase with delicate lines and a wide flaring top). The iris stems and seed pods are softened in hot water until they may be easily shaped and bent into the form of the three elementary lines found in Japanese arrangements. (See page 214.) This provides a permanent frame against which any seasonal flowers are useful all through the year. Since the brown is really a dark orange, any hues analogous to orange can be used, also any contrast to the dark orange would serve, and finally, any single hue with close values would provide color interest if properly scaled and proportioned. All the coppery tones or iris are wonderful in bronze, and every variety of *Hemerocallis* seems just right for the color plan.

We must learn to see the color difference in hues available for flower arrangements, as it may be tied to a form most useful in creating line or massed compositions. Consider the annual larkspur (*Delphinium ajacis*) with its light values of red, and its light and dark blue-violet hues as very useful units to provide height with not too much emphasis on bulk. The pink forms could be the start of a good arrangement in the monochromatic scale; the blue-violet stalks could keynote a handsome analogous harmony. Some types like perennial delphinium (*D. cultorum*) have neighboring hues in their color combinations, going from a pale blue with a hint of green in it, to blue of unusual intensity and several distinctly different illustrations of blue-violet and violet. White flowers are lovely if they hold some visible pigment. Chalk-white gladioli are less beautiful than those which seem to have a glimmer of very pale yellow.

Color Areas

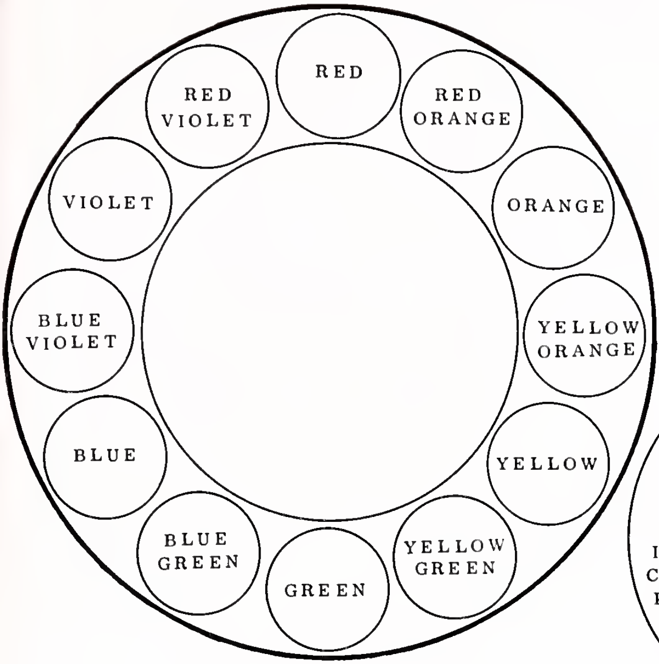
Color must be "designed," which means that it must be scaled and proportioned. The size of each area of color must be harmoniously related to all other areas, and this is possible if there is gradation from large to smaller. Each bud, bloom, stem, and leaf has its personal dimensions or color area, as it appears against space. Groups of small flowers create a larger patch of color when arranged, and variety in the size of each individual piece or group of colors may provide balance in the adjustment of areas and a rhythmic flow of color interest. The completed arrangement should appear to have an over-all harmony which may be identified as an arrangement of pale delicate hues when the form patterns are light and airy, deep rich color when the hues are generally dark in value, or some combination of light and dark which has no sudden contrasts to stop the eye.

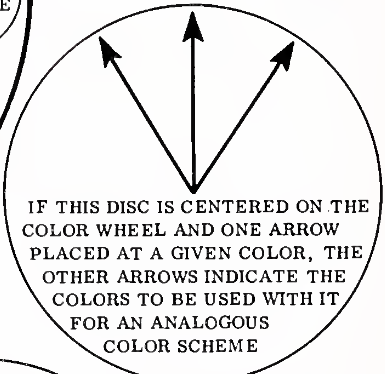
In any design there is generally one dominant factor. In a monochromatic color plan there is one hue dominant, with three variations of value of that hue. The different values should not be too far apart, whether the effect is to be a medium light tone or something darker. The effort is to produce change without shock, and harmony of easy transition.

If the effect is to be an analogous color group, the values can be close together, and the hues can be of about the same intensity. Sharp contrasts of value may upset the color plan. For example, a small spot of bright red in a group of very pale orange and yellow-orange would provide a value contrast which would destroy the harmony of hues.

Where the color plan uses hue contrast (complementary plan) there should be one dominant hue area with the others subordinated and the values harmoniously spaced. The degrees of separation should not be so wide as to produce sharp value contrast. Sometimes taste, in selecting hues which go agreeably together, is the instinctive result of environmental factors.

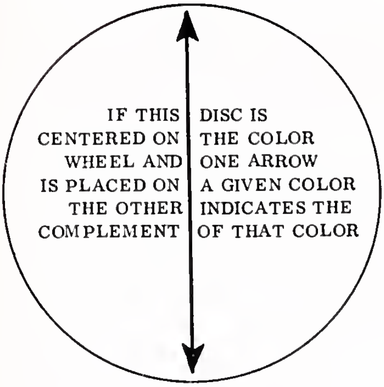
THE COLOR WHEEL IS USED TO WORK OUT COLOR PLANS. ONE BASIC PLAN, THE MONOCHROMATIC, USES ONLY ONE COLOR IN VARIOUS INTENSITIES AND VALUES. THE SMALL DISCS BELOW ARE CUT OUT AND PLACED ON THE WHEEL TO SHOW COLORS FOR TWO MORE BASIC PLANS, COMPLEMENTARY AND ANALOGOUS, AND A COMBINATION OF THESE TWO. STILL OTHER PLANS CAN BE FOUND IN BOOKS ON COLOR.





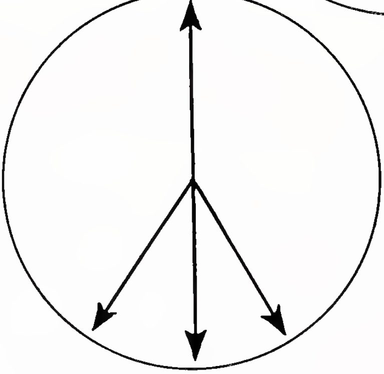
IF THIS DISC IS CENTERED ON THE COLOR WHEEL AND ONE ARROW PLACED AT A GIVEN COLOR, THE OTHER ARROWS INDICATE THE COLORS TO BE USED WITH IT FOR AN ANALOGOUS COLOR SCHEME

ANALOGOUS



IF THIS DISC IS CENTERED ON THE COLOR WHEEL AND ONE ARROW IS PLACED ON A GIVEN COLOR THE OTHER INDICATES THE COMPLEMENT OF THAT COLOR

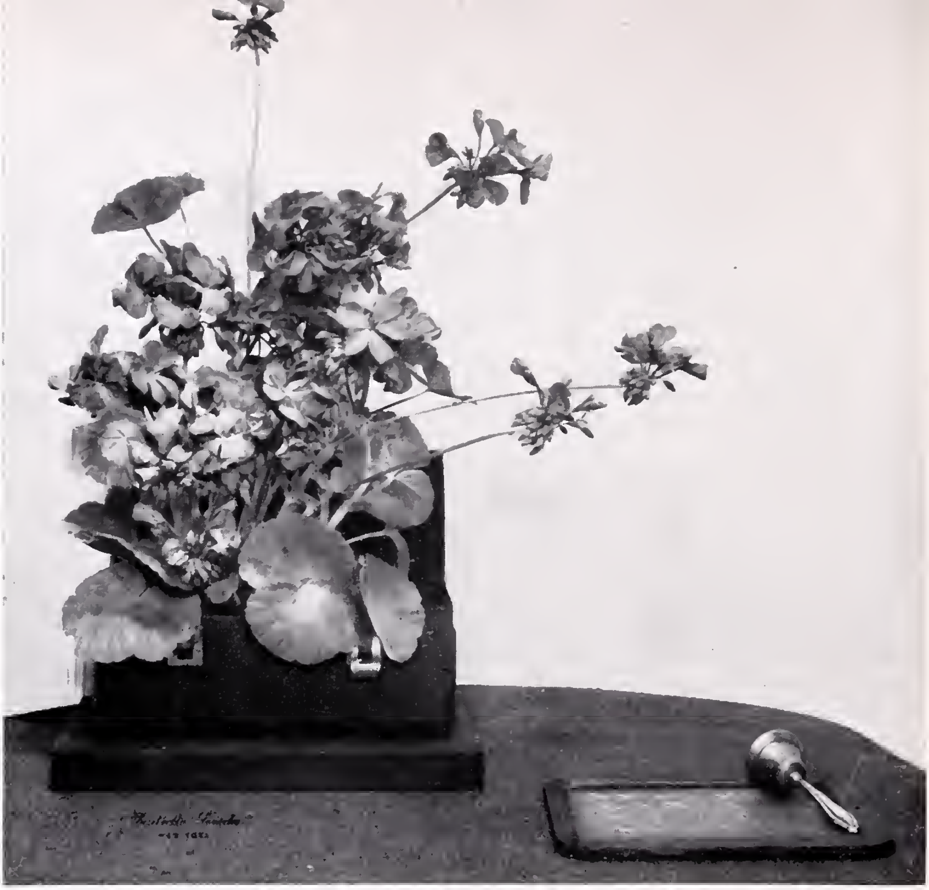
COMPLEMENTARY



COMBINATION OF ANALOGOUS AND COMPLEMENTARY

PATTERN FOR COLOR WHEEL

Color is wrong only in the way we may put it together. A color wheel is a measuring tool, easy to use and carry around. Natural color has a few limitations—sometimes the needed color cannot be found in the right form, but much of the profusion of color around us does not reach our consciousness unless we start the process of seeing and evaluating it. There are wonderful combinations always possible to the discriminating viewer and interested student.



Arranged by Cecilie Baehr *Boutrelle-Sevecke*

"School Days"—red geraniums in lunch box container.

INTERPRETIVE FLOWER ARRANGEMENT

Inspiration, imagination, and emotion are vital to the success of an arrangement

Grace Coyle

ON THE material plane all good flower arrangements are designed in three dimensions. In height, the vertical axis is carefully established with regard to the mass of the container, the width along the horizontal axis gives required balance and stability, and depth is gained by the placing of background and foreground materials to give sculptured quality. These three factors constitute design in the round. All these attributes of good composition may be achieved by following rules, resulting in a technically perfect arrangement—a sure blue ribbon winner in competition. But there is a fourth dimension, the spiritual plane, where inspiration, imagination, and emotion are the most important measurements.

More and more flower show schedules

are being planned with the purpose of giving the artist an opportunity to design upon this higher plane. A non-competitive invitation class may be the feature of a show, presenting a theme—"Abundance," "Faith," "Westward Ho"—for the exhibitor's interpretation. Better still is the schedule where many of the competitive classes are titled, stimulating the imaginations of all the exhibitors, and so raising the appeal of the whole show, not only to the club members, but to the public who come to see. How much more interesting to look at a composition called "Country Fair" rather than "An Arrangement of Fruits and Vegetables," or "Skyscraper" instead of merely a "Tall Arrangement."

Introducing the fourth dimension into flower arrangement makes the judge's task more difficult. It calls more for sympathy, almost telepathy, than for technical knowledge to evaluate the exhibits. And how can any group agree or even compromise on the spiritual? Perhaps it is best, then, that highly interpretive classes should be non-competitive. Certainly it is best for the artist, allow-

Arranged by Mrs. E. L. Alexander

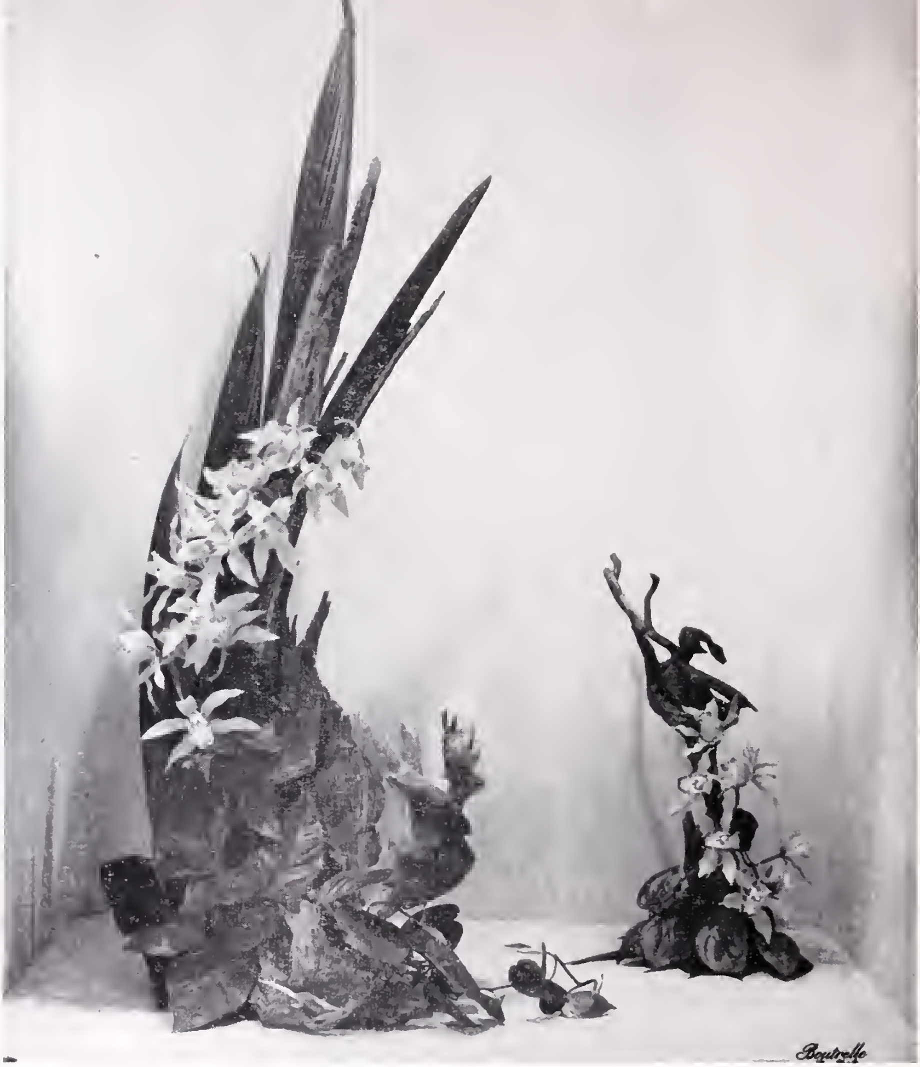
Boutrelle-Sevecke

"Crystal Clear Thinking"—lilies in crystal vase and crystal grapes.

Arranged by Grace Coyle

SEAF Camera News

"The American Scene"—typified by the soda fountain. Creamy white fragrant flowers are the "soda," creamy white eggs on a blue glass plate are accessories.



Arranged by Grace Coyle

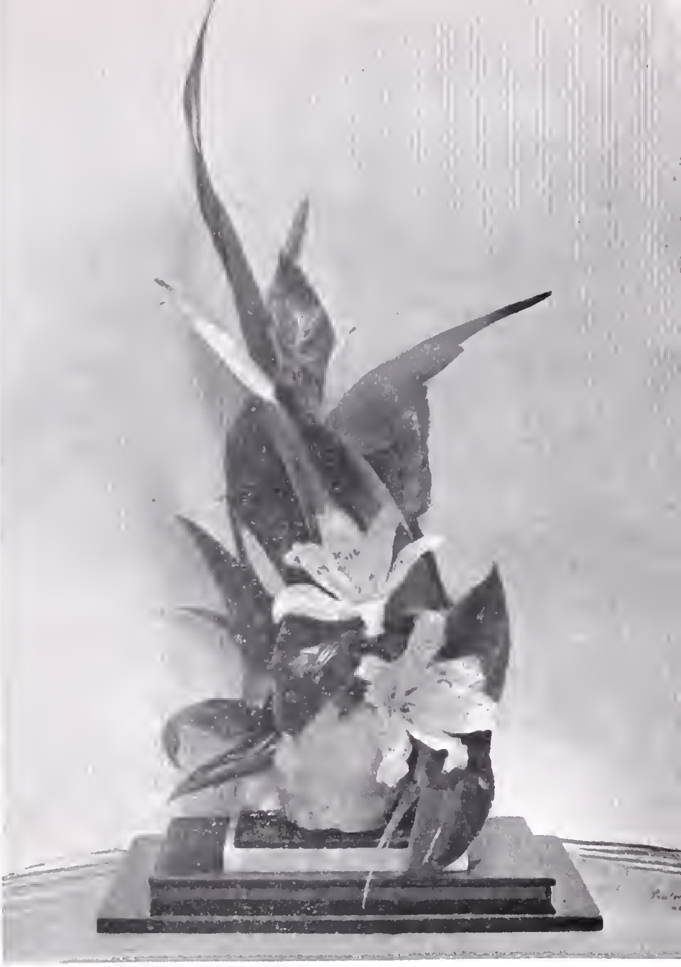
"Afternoon of a Faun"

ing absolute freedom of expression, and so best for the flower show visitors, awakening them to the possibilities of this great art.

As in all creative work, true inspiration is often experienced by the designer of interpretive flower arrangement. The ballet composition, "Afternoon of a Faun," has been said by critics to have "reached the heights of flower arrangement in its imaginative and lyrical quality." The entire plan for it came to the artist as an inspirational "flash." She felt that the Debussy composition should be expressed without the aid of manufactured accessories, figures and so forth. Among her collection of roots was a perfect torso with outstretched arms and laughing head, and another, a nymph with flying hair—and the idea "clicked." Late afternoon, an ancient garden, the roots of the old tree, and the branches of the dead shrub on which orchids climb, come to life. The pearl-gray background gives an atmosphere of dream; the whole makes a happy demonstration of the "fourth dimension" in an interpretive flower arrangement.

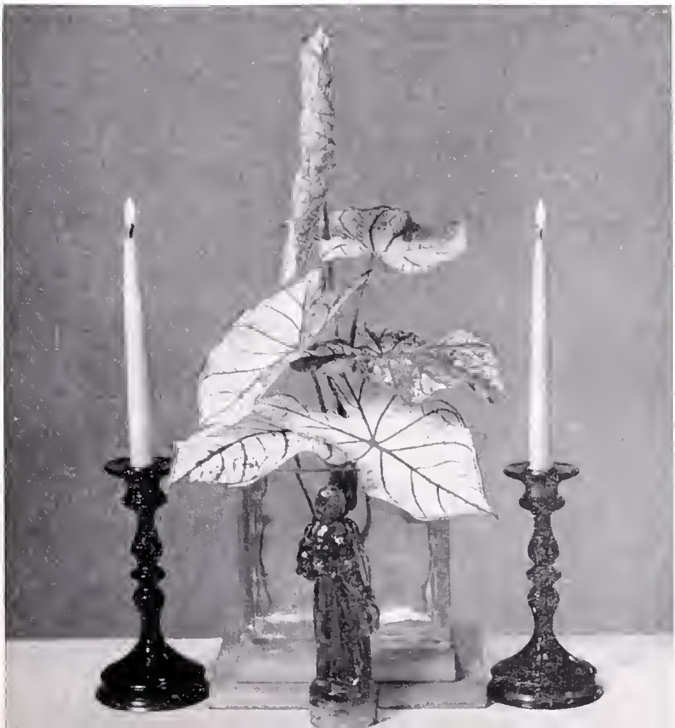
"Bird in Flight" — lilies and foliage, carved bird accessory.

Arranged by Mrs. H. E. Herrman



Stuckey

Boutrelle-Sevecke



"Midwinter"—cold is suggested in this arrangement by glass brick container, ice-blue glass figurine and candle sticks, and cool green and white caladiums.

Arranged by Grace Coyle

Arranged by Mrs. George J. Hirsch *William Leffler*

Striking pattern of three separate pieces of driftwood is accented by garden flowers.

NATURE'S HEIRLOOMS

How to find and finish driftwood for use in decorating

Sylvia Hirsch

AN INTEREST in driftwood, as an art form, has grown continually over the past 20 years. Hardly a flower show is held that does not include a class for it, specifically or generally. Many homes, modern and traditional, include it as an accent or accessory in one of its many varied forms and finishes.

We see driftwood used in its rough natural state, semi-smooth, or with completed finish, as "sculptured wood." The type and finish one selects are determined only by one's personality, likes and dislikes, and by the use to which the wood is going to be put, either in one's home or in a flower show. Each type has its own characteristic appeal, and when used in an appropriate setting can create a delightful note of interest.

Many summers ago while canoeing on Raquette Lake in the Adirondacks, I became aware of the odd and rare shapes of the old branches and roots of the tumbled-down trees along the lakeside. Almost suddenly, I found fantasy and beauty in these forms. Their possibilities seemed endless. I gathered several pieces of driftwood from the edge of the lake and others from the bottom. This was the beginning of what ultimately proved to be a well of inspiration which served as a satisfying source of artistic expression.

Sources

Driftwood is found along the shores of many lakes and rivers; some may be washed up on the sands from the sea along the coast. All of mine I discovered in lakes in the Adirondacks, Maine, and Canada. They are pieces, not of rare wood, but of pine, spruce, maple, birch, or cedar. Any tree that had grown in that region and had fallen into the lakes might be found as driftwood.

Selection

The first and most important factor in finding unusual driftwood is to develop a seeing eye. I have picked up and rejected hundreds of pieces of wood before selecting one that I thought had interest and artistic possibilities. Seeing and then discriminating can make the difference between an ordinary and a highly distinctive collection.

Finishing

After having found a piece of choice driftwood, the way we proceed from here is determined by where we intend to use it, or for what purpose.

Unfinished, or in its original state, it can be used in a camp or lodge effectively, or in a flower show calling for an arrangement in a natural container. Semi-finished merely means cleaned and sanded. It changes the surface of the wood from a rough, crude texture to one less so, making it acceptable for use in an informal setting, such as a ranch house or simple suburban cottage. Cleaning is done with a stiff brush. The wood is allowed to dry thoroughly, after which it is sanded. Use coarse sandpaper first, then medium, and, if a very smooth surface is desired, finally use double-O sandpaper or emery cloth.

For the beautifully finished driftwood which I call "sculptured wood," the previous steps should be followed, giving careful attention to the final step which is most essential for the finished result. The next is to decide on the color—do you want it natural, walnut, mahogany, maple? The place or room in which the piece is going to be used will help you decide. For a certain table mahogany might be good—the piano might complement walnut or pine, and so on. If the wood is to be used mounted as an abstract piece of wood sculpture, it might be left the natural color. Select a good oil stain, apply a thin coat, and wipe off after 15 minutes. Allow to dry at least 24 hours. If one has time and patience, apply a second coat and again allow to dry for 24 to 48 hours. Now the wood is ready

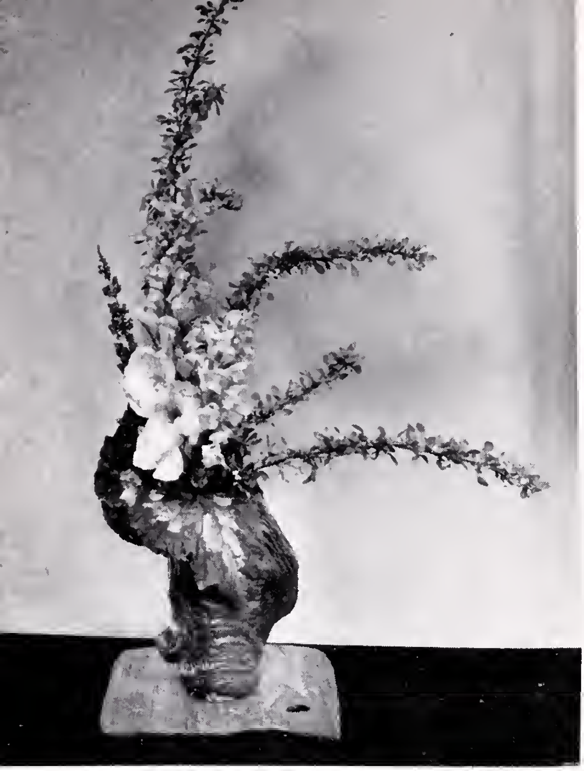
Arranged by Mrs. George J. Hirsch

Antique-finished driftwood with celosia, fruits and vegetables.

Succulents complement fine finish of beautiful piece of walnut wood sculpture.

Arranged by Mrs. George J. Hirsch

Boutrelle-Sevecke photos



Arranged by Mrs. George J. Hirsch

Barberry, red snapdragons, pink gladioli, heather, and begonia foliage in driftwood container.

for waxing. Apply a very thin coat of liquid wax, buff with a soft cloth. Next day, for the final coat, use paste wax and rub vigorously to an elegant patina. This should give as fine a finish as on most of the beautiful woods in your home.

Use With Any Style

Sculptured wood can be compatible in any period home—it is so adaptable in design, color, and finish texture. Simple pieces carry the spirit of the early American homes—more elaborate ones the traditional, and certainly those that are dramatic and exotic complement our contemporary or modern way of life.

The varied forms, finishes, textures, and colors are also adaptable to flower show work. There is much to find and choose from — but remember, in selecting nature's rare specimens, they must say something. They should have a feeling of motion and flow. They must be rhythmic. Lacking rhythm, they are just static roots or stumps with no artistic value or appeal.

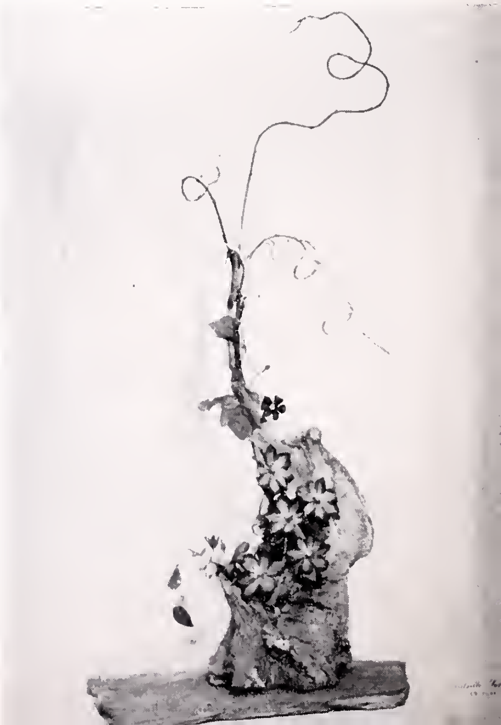
Woodsy plant materials have an affinity for natural driftwood. The exotic and the more elegant plants and foliage are equally interesting and related if proper forms and textures are selected. I have used almost every kind of flower, fresh and dried, wild and cultivated, and have been able to find one of nature's heirlooms to harmonize.

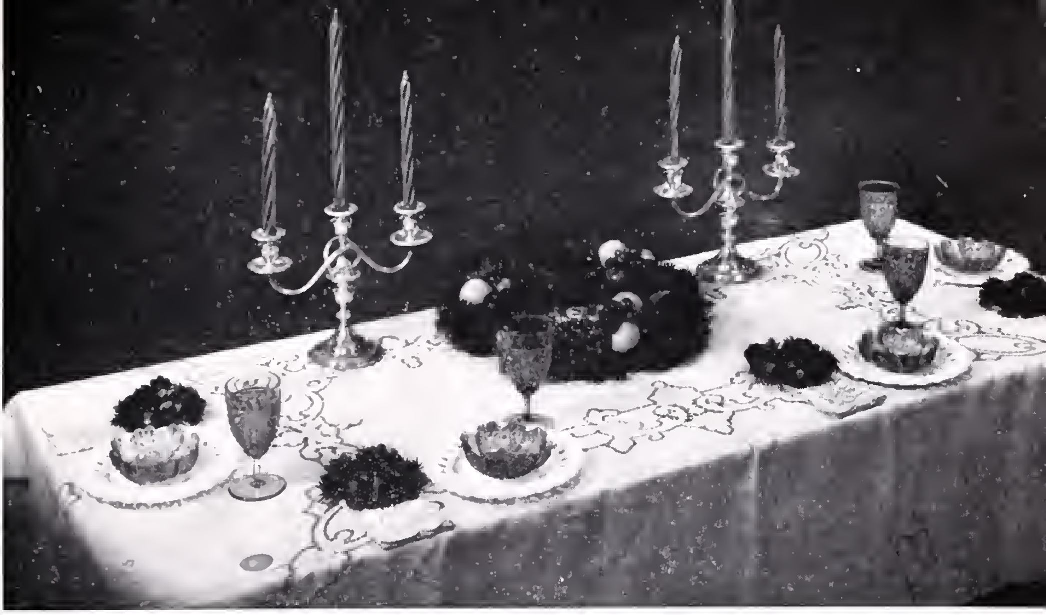
In collecting woods, try to find pieces that have practical as well as artistic possibilities. What you discover in your adventure will be an expression of your own imagination—we all see things differently. The important thing is that we see.

Unfinished driftwood provides foil for blossoms of clematis.

Arranged by Mrs. H. D. Hunter

Boutrelle-Serecke photos





Arranged by Mrs. William Haller *Boutrelle-Sevecke*

Della Robbia wreath as centerpiece for holiday table.

TABLE SETTINGS

How to plan the centerpiece; and some timely suggestions for the hurried hostess

Julia S. Berrall

The Centerpiece and Table Proportions

THE proportions of the table centerpiece should be considered in relation to the shape and size of the table. Oval or rectangular tables are undoubtedly the kind most often in use and they lend themselves more readily than any other shape to an attractive setting. A flower arrangement planned for such a table is usually oval and should be scaled to the actual table size, not so small as to look lost in the middle and not so large as to dip into glasses and butter! This will apply, of course, to every arrangement, whatever the size and shape of the table.

It is difficult to give exact dimensions for proportioning a centerpiece because its size may have to vary according to the number of places to be set, the size and shape of your container, the flowers you are using, and so on. However, on a 6-foot table, with seating at ends as well as sides, the centerpiece should work out to approximately 20 inches long, leaving room for candles at each end. If candles

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are not used, it could then extend to about 24 inches. The width will depend on the width of the table, the requirement being that there should be several inches at least between it and the settings along either side.

The narrow, refectory type of table represents a greater problem, for the center arrangement must be made long and narrow to fit its shape, and suitable containers are more difficult to find for this purpose than any other. (One piece of advice—buy them when you find them! If you "wait till later" and go back intending to buy, the piece you saw will probably be gone.) However, pairs of arrangements also look well on the refectory table, and this is often an easy way out. They may be placed on either side of the center, or at the ends where they will tend to shorten the table span.

The round table or the drop-leaf, which makes a square, have equal proportions and call for a rounded and often fuller arrangement than is necessary for the narrow table.

Give some thought also to the height of candles, glassware, and flower arrangements placed on any table where eating takes place. Keep the center decoration low enough so people can talk over it and let your glasses and candlesticks introduce varied heights to relieve the monotony which otherwise occurs when too many articles are at the same eye level.

What To Do In a Hurry

Once in a while we all have unexpected guests visit us in the late morning or afternoon and we ask them to stay to a meal. Usually they will be old friends to whom we offer pot luck but at other times we feel we should definitely put our best foot forward. Besides a few dishes that can be speedily prepared, it is good to have in mind certain decorating ideas which can be put together in a hurry. In the summertime it is easy enough to run out into the garden, pick some flowers, and fashion them into one or another of your accustomed arrangements. And in the city the florist around the corner may come to your rescue. But when there are few, if any, flowers at your disposal, what can you do?

1. An evergreen foliage arrangement is one of the quickest and easiest to make. If you live in the country or suburban house, grab the pruning shears and see what the foundation planting has to offer.

2. Just a few flowers simply arranged: the last three remaining roses in the garden, or a few precious Christmas- or Lenten-roses (*Helleborus*) will make a whole arrangement if given scale by the addition of foliage. Don't ever try to center these when placing them in a low flat container. They are much more effective placed at one side with exposed water surface providing the needed counterbalance.

Arranged by Helen Paine *Cosco Studios*

Dinner tables laid with chartreuse satin cloths; flowers are gardenias, yellow roses, and tulips in silver urns.

3. Figurines and accessories are decorative in themselves but often they are more decorative if combined with some living plant material.

4. Only a few broad leaves are needed to set off attractively a simple arrangement of ceramic fruit. There is also Mexican pottery fruit which can be used in the same manner—with similarly rugged dishes.

5. Certain special vases with candle holders incorporated in their design are most useful. A minimum of foliage or flowers is needed to give the feeling of an entire arrangement.

6. For those who dine formally, no matter what the occasion, an antique silver epergne placed in the center of the table will more than pinch-hit for a flower arrangement. The branched silver epergnes that were made in England in the eighteenth and early nineteenth centuries are highly decorative. Usually there is enough fruit on hand to arrange in one of these. Grapes, small apples, lemons, and limes, plus a few leaves such as ivy or laurel can make a centerpiece worthy of any mahogany table set with porcelain plates and crystal glasses. Most evergreens, when they are placed in fruit arrangements, will last without water, but should you wish to give them longer life, you can obtain small glass or plastic tubes with rubber ends in which orchids are shipped. After filling the tube with water, poke the leaf stem through the hole in the rubber and arrange at whatever angle you wish, concealing the tube among the fruit.

If you want to be fully prepared for the unexpected guest, have your ideas for the situation well catalogued in your mind, and keep a special corner, where you store your vases, for the properties needed when a quick arrangement is called for. Experiment with a few ideas of this kind for the fun of it and you will be ready for any eventuality.

Arranged by Mrs. William Haller

Fall arrangement featuring wheat and chrysanthemums.

Arrangement for bridal table.

Arranged by L. Barton and J. A. McCabe

Boutrelle-Serecke photos

HOW TO MAKE YOUR OWN CONTAINERS

Directions for making attractive containers from simple materials

Rae L. Goldson

SEARCH the soul of a gifted flower arranger and you find not some impractical aesthete or dreamer but a person who is something of a carpenter, a little bit of a chemist, kind of an engineer, a scavenger, always on the hunt not only for plant materials but also for pieces of rare fabric, unusual containers and objects that can be made into containers, and sculpture and ornaments for arrangements. You are apt to come across this kind of arranger in the depths of a musty antique shop, haunting art galleries, or in her own work room, a solderer or paint brush in hand. One of the contradictory aspects of flower arranging as an art is that the most ethereal, delicate, and spontaneous creations are often the most solidly constructed, anchored by deft hands to lasting permanency. To achieve this kind of composition takes an exploring, enquiring mind always eager to pick up some new knowledge of metal work, ceramics, painting, carpentry, or other arts and crafts. For this reason a discussion of mechanics, techniques, and containers belongs in any book on modern arranging.

The important thing to consider is not so much the period, for in modern rooms traditional accessories often find a place, but the color, form, and texture of the container and the degree to which it carries out the spirit of the arrangement.

The container, above all, should be functional. It should be large enough to hold the pinholder and enough water to keep your plant material fresh as long as possible. Whether you use a flat dish, tall vase, bowl, or just a can, there should be the proper mechanics to hold the plant material firmly in the position you want.

Containers should not be too elaborate in design or too glamorous in color. The shape, size, and color should be selected with the thought in mind of the finished arrangement.

Looking for and collecting containers will become quite a hobby after awhile. You will be surprised to find that many articles not originally intended for flower arrangements, and which in fact had most prosaic original functions, make wonderful containers.

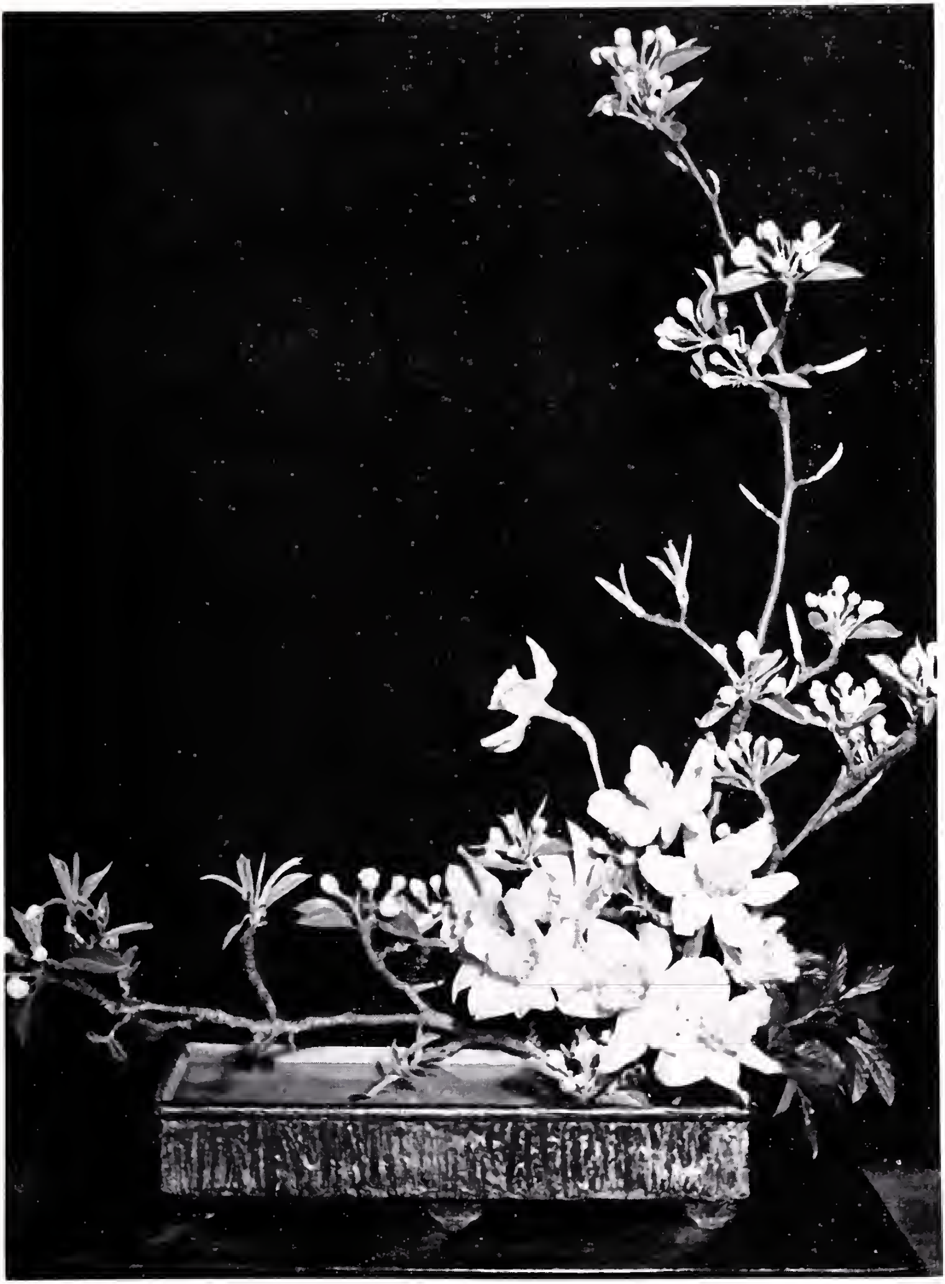
Baking Tin Container

For something unusual in a low container, use an old baking tin, covering the sides with gesso plaster (which comes in a can and looks like whipped cream). To get an interesting effect mark the wet plaster by rubbing a fork up and down it to obtain a rough surface. After the plaster has dried, apply a coat of paint in any color you prefer. Rubbing the surface with some bronze powder with bronzing liquid gives a metallic finish.

Homemade Wooden Containers

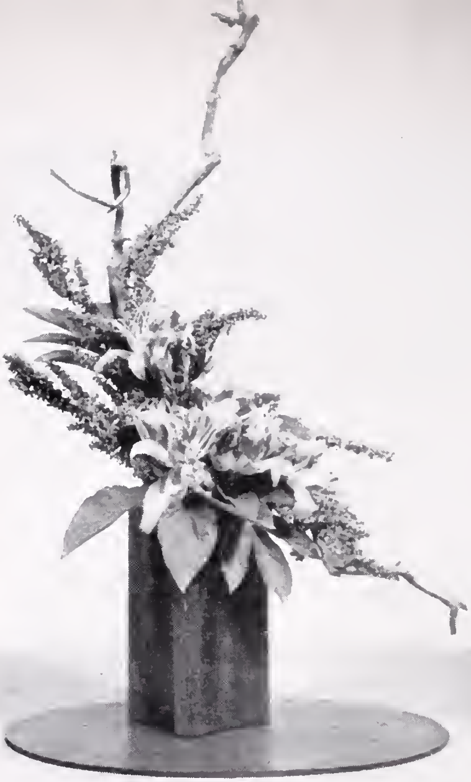
A wooden container is easily made at home. To make one of these homemade containers, cut molding 2½ inches wide into four 8-inch lengths. For front and back join two strips of the molding with

This article is an excerpt from Mrs. Goldson's book, *Contemporary Flower Arrangements*, published by Hearthside Press, Inc., New York, $3.50. It is used here by kind permission of the author and publishers.



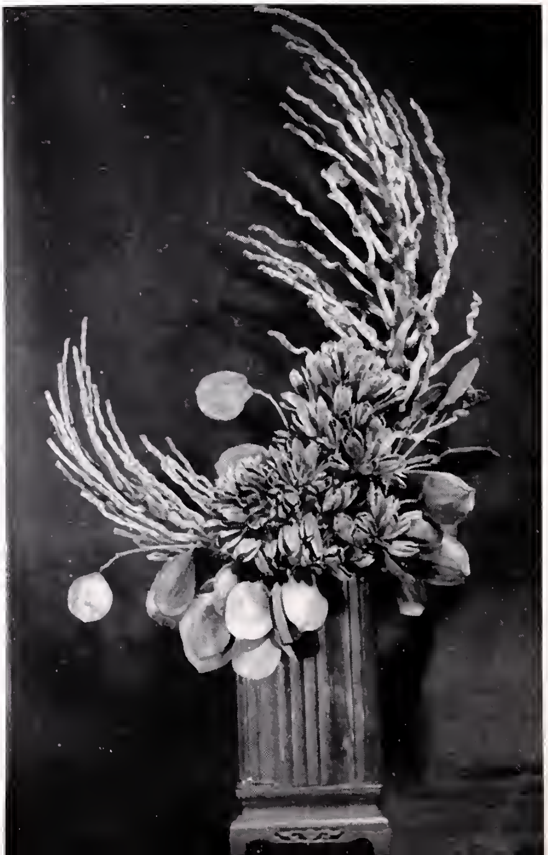
Arranged by Rae Goldson *Bramore Studio*

Low container made from aluminum baking pan covered with gesso plaster contains pear blossoms and yellow daffodils.



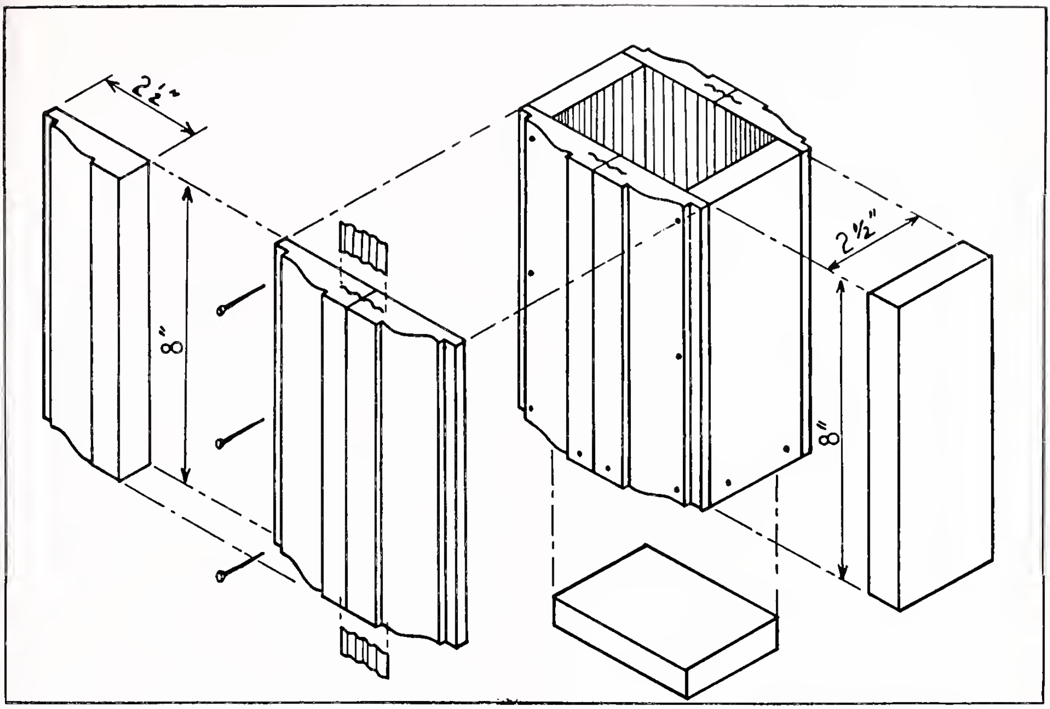
Hemerocallis, dock (*Rumex*), and driftwood in container made from concave wooden molding.

Arranged by Rae Goldson
Bramore Studio



Dried arrangement in home-made wooden container.

Arranged by Rae Goldson
Boutrelle-Sevecke



Drawn by Henry Goldson

PLAN FOR HOMEMADE WOODEN CONTAINER

Materials:

For front and back: Four 8-inch strips of 2½-inch molding
For sides: Two 8-inch strips of wood 2½ inches wide
For bottom: One piece of wood 2½ inches wide
Corrugated nails, brads

corrugated nails at top and bottom. The sides are single straight 2½-inch strips joined to front and back panels with small brads on each side. The bottom should be cut from the same 2½-inch strip and should fit snugly. Then you can insert a tin can for a water holder or else have a tinsmith put in a tin lining. Some moldings have convex, others concave designs. Ordinary pine molding will do. It may be finished in walnut, maple, and other wood stains, or painted any color you desire. A variation can be made of only four pieces of crown molding joined together top and bottom with corrugated nails and a bottom inserted.

Wooden containers are very versatile since they can be used for both dry and fresh material as shown in the illustrations.

PERIOD FLOWER ARRANGEMENTS

Materials and accessories to use and how to arrange rich-looking bouquets in four period styles

Margaretta Davis

MASS floral compositions such as those pictured and described here are so beautiful as to be well worth the time and effort spent in producing them. Period arrangements not only make use of the flowers and accessories which were in vogue during a certain time, but reflect the very spirit of that time. The four representative styles given are of course but a sample. There are many variations and many other periods.

When spring and summer flowers are plentiful, why not arrange one or more of these beautiful bouquets to brighten your home and add to the joy of living. The choice of period you try naturally will depend upon the decor of your own home and upon your individual preferences.

Flemish

Painting a floral picture in the Flemish manner, using fresh cut plant material is, I think, a most satisfying accomplishment. The Flemish style is a massing of plant material combining rich colors in tones of red, warm yellow, violet, blue, and orange. Fruits, insects, birds, their nests with eggs, lizards, shells, and such are incorporated in the design. The composition here might have been created in the late seventeenth century when flower painting was at its peak.

The container used is a classic style urn, metal with an antique bronze finish. Won't you join me in recreating this picture step by step?

First step. A pin holder of good size to accommodate the quantity of plant material used is anchored firmly in the container with paraffin wax. A small doweling stick about the thickness of a pencil and about 10 inches long, painted green, is driven well back in the pin holder, thus giving a strong support to which to anchor the tall plant material.

Second step. The first placement of material is grape-ivy vine (*Cissus rhombifolia*) which has been tied with very fine green thread to a slender, flexible piece of shrub. This is placed well back in the pin holder and tied to the doweling stick; the length of this vine is twice the height of the container. The next placement is grape-ivy vine sweeping downward and to the left, these two lines forming a gentle S-curve which will be followed throughout the arrangement.

Third step. Violet stock is placed in the back on the left; four pale blue irises follow the grape-ivy line at the top; deep pink tulips run through the center; parrot tulips (FANTASY) start at the lower right grape-ivy line and run up on the right flowing into the deep pink and purple anemones. On the left center are placed three yellow irises and two yellow ranunculuses. Near the butterfly there are several deep pink roses; also on the left, freesia (peach with a tinge of violet) rounds out the design. On the right two bunches of spring star flower (*Brodiaea uniflora*), white tinged with blue, add an interesting change of form—these little flowers were bunched in the hand and tied together. A lone white calla lily (*Zantedeschia*) nestles at the right center; under it two Spanish irises.

The flower arranger must remember to come forward in the pin holder with each placement of material, thereby helping to achieve depth. The back and profile of a flower or leaf will add interest and also give depth, leading the eye around the picture.

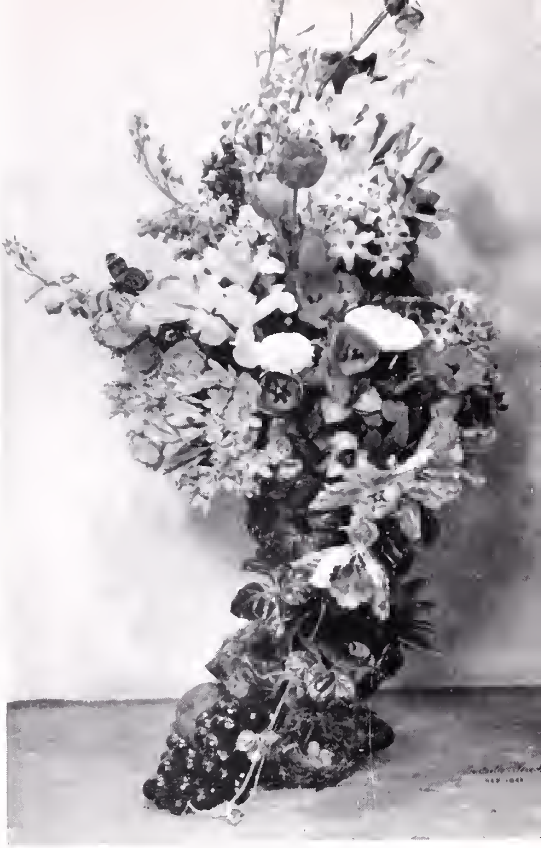
Fourth step. In back of the container on the heavy textured deep rose velvet foreground material, a large pineapple is placed horizontally on a pin holder with its top showing on the right of the container. On the left are placed a whole and a half pomegranate against the pineapple. The black grapes spill forward adding depth while their color picks up the black centers of the tulips and anemones in an upward rhythmic movement. To complete this Flemish picture a bird's nest, with its three brown-spotted turquoise eggs made of paraffin wax, rests against the base of the container. These accessories and the plant material almost completely hide the container as was often the case in the Flemish floral paintings.

It is advisable, when possible, to use materials appropriate to the period although market conditions at times are such that substitutions necessarily have to be made. Such was the case in this arrangement.

Appropriate Containers. Bronze ewers and urns, majolica pottery, bowls, gilded metals, amber and deep green glass vases and goblets, Chinese ceramics, delftware, and classic urns in terra cotta.

Appropriate plant material for Flemish arrangements:

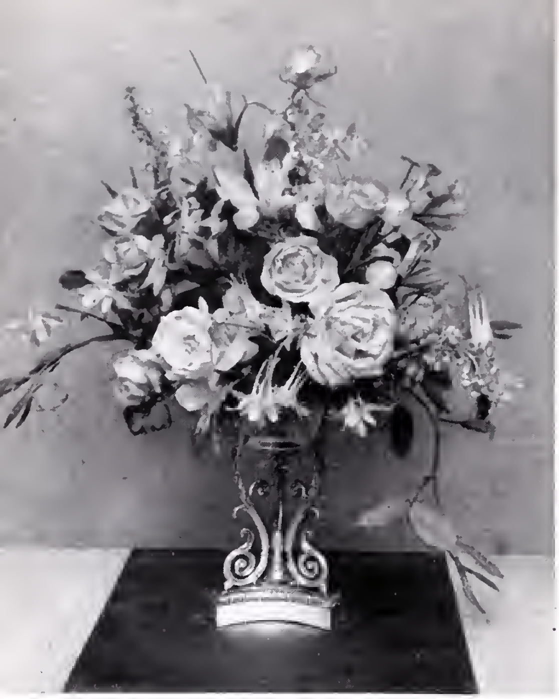
Aloe
artichoke (*Cynara scolymus*)
Anemone
Calendula
Chrysanthemum
carnation (*Dianthus caryophyllus*)
cockscomb (*Celosia*)
columbine (*Aquilegia*)
crown imperial (*Fritillaria imperialis*)
Cyclamen
forget-me-not (*Myosotis*)
hyacinth (*Hyacinthus*)
hollyhock (*Althaea rosea*)
ivy (*Hedera*)
Iris (bearded and bulbous)
larkspur (*Delphinium*)
lilac (*Syringa*)



Arranged by Margaretta Davis *Boutrelle-Sevecke*

Flemish arrangement.

lily-of-the-valley (*Convallaria*)
Madonna lily (*Lilium candidum*)
Turk's-cap lily (*L. superbum*)
love-lies-bleeding (*Amaranthus caudatus*)
African and French marigold (*Tagetes*)
morning-glory (*Convolvulus*)
Narcissus
nasturtium (*Tropaeolum*)
orange (*Citrus*)
passion flower (*Passiflora*)
peony (*Paeonia*)
periwinkle (*Vinca*)
pink (*Dianthus*)
poppy (*Papaver*)
Ranunculus
apple rose (*R. pomifera*)
cabbage rose (*Rosa centifolia*)
damask rose (*R. damascena*)
sulfur rose (*R. hemisphaerica*)
rosemary (*Rosmarinus*)



Arranged by Margaretta Davis

French arrangement.

Scabiosa
stock (*Mathiola*)
sunflower (*Helianthus*)
teasel (*Dipsacus*)
thistle (*Cirsium*)
tulip (*Tulipa*)
  white, yellow, rose-red, red and yellow broken, Bybloemen (purple on white ground), rose and white broken, sometimes doubles and parrots
trumpet vine (*Campsis*)
tuberose (*Polianthes*)

acorns
celery
cherries
chestnuts
currants
figs
gooseberries
gourds
grapes
lemons
melons
onions
parsnips
peaches
pineapples
plums
pomegranates
scallions
walnuts
wheat

French

The French arrangement gives a feeling of elegance, yet is dainty and frivolous. Playful curves and delicate scrolls are incorporated in the design in a graceful manner. Colors favored are shell-pink, pale and golden yellow, soft greens, pale blue and dark blue, violet, touches of red, buff, cream, mauve, white, and purple. Colors should be selected for their harmonious effects.

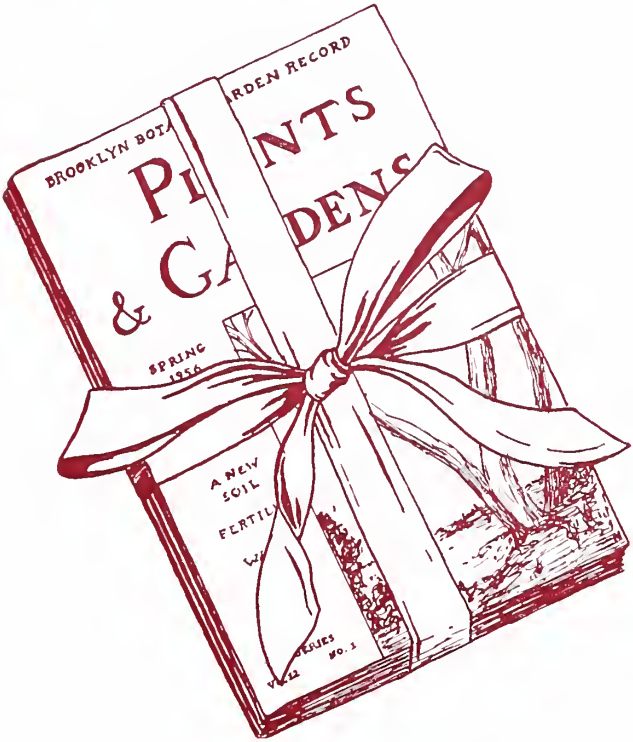
The container used here is of clear, cut crystal of low, round form supported by a gilded metal pedestal. A pin holder was gilded, placed in the container, and held there by a small amount of paraffin wax, thus making it a part of the whole. The materials used are perennial pea vine (*Lathyrus latifolius*) with its curving tendrils which repeat the scroll design of the pedestal, the interesting columbine (*Aquilegia*) with its pale yellow sepals and pink spurs, blue Dutch iris with its yellow markings, yellow Dutch iris, lush pink roses (in full bloom and in bud), and three delphiniums in shades of blue. To complete the picture, the arrangement was placed on a gold satin foreground against a mauve painted wall. This picture might suggest a portion of an embroidered French wall panel.

Appropriate containers. Sèvres porcelain, crystal, tole, alabaster, baskets (low, high, made of silver, porcelain, or reeds), epergnes, tasse with stems of spiraling dolphins or human figures, Chinese porcelains, gilded metals, cache-pots.

Appropriate plant material for French arrangements:

Anemone
Aster
batchelors' button (*Centaurea cyanus*)
buttercup (*Ranunculus*)
balsam (*Impatiens balsamina*)
Campanula
Canna
Canterbury bell (*Campanula medium*)
cherry (double flowering) (*Prunus*)
Clematis
daisy (*Chrysanthemum leucanthemum*)
Delphinium
fern
guelder rose or snowball (*Viburnum opulus roseum*)
hollyhock (*Althaea rosea*)

here is the ANSWER



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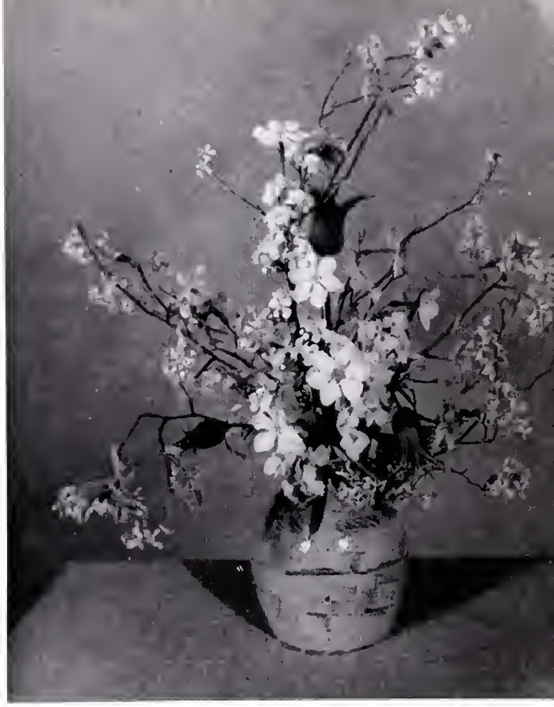
honeysuckle (*Lonicera*)
hyacinth (*Hyacinthus*)
Iris (bearded and bulbous)
jasmine (*Jasminum*)
lavender (*Lavandula*)
lilac (*Syringa*)
Madonna lily (*Lilium candidum*)
African and French marigold (*Tagetes*)
morning-glory (*Convolvulus*)
Narcissus
nasturtium (*Tropaeolum*)
passion flower (*Passiflora*)
peony (*Paeonia*)
pink (*Dianthus*)
primrose (*Primula*)
Ranunculus
bengal rose
cabbage rose (*Rosa centifolia*)
damask rose (*R. damascena*)
sulfur rose (*R. hemisphaerica*)
sage (*Salvia*)
Scabiosa
snapdragon (*Antirrhinum*)
stock (*Mathiola*)
sweet pea (*Lathyrus odoratus*)
sweet william (*Dianthus barbatus*)
thyme (*Thymus*)
tulip (*Tulipa*)
violet (*Viola*)
wallflower (*Cheiranthus*)
oranges
nectarines
strawberries
pineapples
grapes
melons

Colonial

Floral arrangements in Colonial New England were simple, casual mixed bouquets using color contrasts rather than harmonious color combinations. Favored colors were red, vermillion, delft blue, lavender, white, yellow, purple, and green.

The Chinese ginger jar used here is of a rather coarse-textured porcelain, pale gray-beige with a blue design and is appropriate for spring flowers. Double white cherry blossoms, *Amelanchier*, narcissi (*N. poeticus*), blue phlox (*Phlox divaricata*), red tulips, and yellow wallflowers (*Cheiranthus*) are used in a sweetly simple bouquet. The material is held in place by filling the jar with sand to within 2 inches of the rim. This picture is completed by placing the arrangement on pale gray-beige monk's cloth.



Arranged by Margaretta Davis *Meredith photos*

Colonial arrangement.

Appropriate containers: pewter bowls, tankards, mugs and teapots, copper and brass kettles, Chinese porcelain, Dutch delft, earthenware, pottery jugs, bean pots and baking dishes, gourds, iron pots, and baskets made of bark.

Appropriate plant material for Colonial arrangements. The lovely New England countryside had many native wild flowers such as black-eyed susan (*Rudbeckia hirta*), goldenrod (*Solidago*), and *Aster;* flowering trees and shrubs, such as dogwood (*Cornus*), laurel (*Kalmia*), shadbush (*Amelanchier*), and sumac (*Rhus*). Later the settlers introduced marigolds (*Tagetes*), gilliflowers (*Mathiola* or *Cheiranthus*), roses, and fruit trees such as apples, pears, quinces, cherries, and plums. Other suitable plant material:

beebalm (*Monarda*)
bittersweet (*Celastrus* or *Solanum dulcamara*)
clove pink (*Dianthus caryophyllus*)
fern
fox glove (*Digitalis*)

geranium (*Pelargonium*)
hollyhock (*Althaea rosea*)
honesty (*Lunaria*)
Queen Anne's lace (*Daucus carota*)
rosemary (*Rosmarinus*)
rose (*Rosa*)
sweet william (*Dianthus barbatus*)
tansy (*Tanacetum*)
trumpet vine (*Campsis*)

Victorian

Victorian flower arrangements in keeping with the carved, overstuffed furniture of Queen Victoria's time were compact and heavily massed. The use of a great variety and quantity of plant material often concealed the beauty of the individual flower. The colors were confused and spotted—strong color contrasts rather than harmonies were used. Favored colors were magenta, mulberry, ash-rose, yellow, orange, lavender, mustards, and reds. Flowers and leaves often chosen were spotted, striped, and variegated, frequently of a velvety texture and sweet fragrance. The designs followed were either globular or circular.

The container used here is a quaint, footed, white, opaque Venetian glass bowl having glass decorations in relief. The full-blown glass rose and buds are a dusky shade of magenta; the leaves, green; and the stems, handle, and three feet, amber. The top of the container has a scalloped edge. The crushed moire silk foreground is of the same shade as the rose on the container and blends with the tints and shades of magenta throughout the arrangement. The plant material used here is columbine (*Aquilegia*), purple Spanish iris, geum (white, light and dark pink), white Dutch iris, white peony, sweet william (*Dianthus barbatus*), (white, pink to dark red), carnation (white and red variegated), fuchsia, bleeding-heart (*Dicentra spectabilis*), lemon-lilies (*Hemerocallis*), rose geranium (*Pelargonium graveolens*), roses (deep pink to red), lupine (blue, rose).

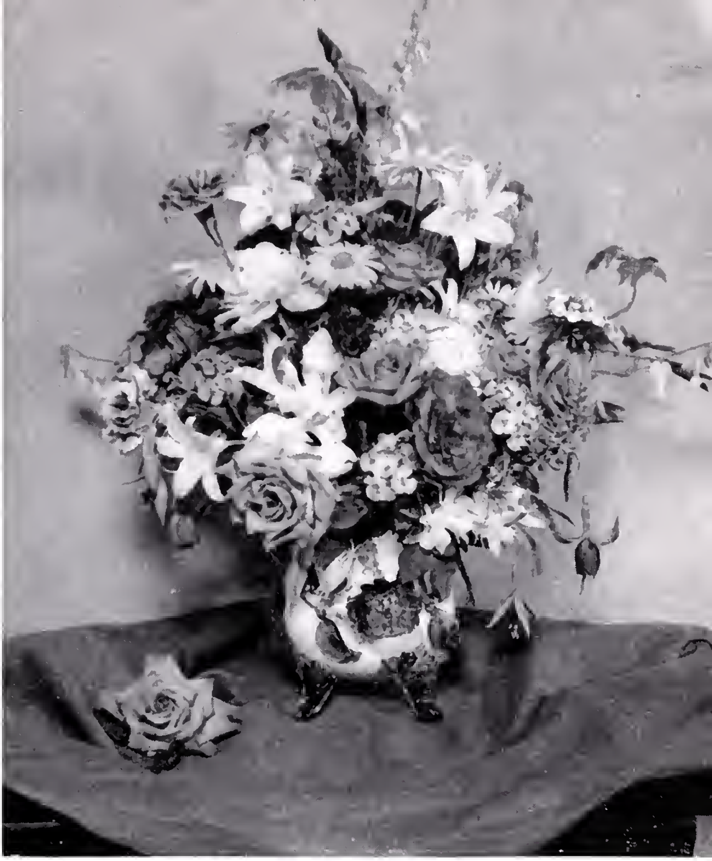
The fully described construction of the Flemish composition will act as a guide for the Victorian arrangement, since the mechanics and techniques of all mass arrangements are similar.

Appropriate Containers: epergnes, hand-painted porcelain, milk, satin, and pressed glass, alabaster urns and compotes, quaint shapes such as slippers, hats, hands in glass or porcelain are used.

Appropriate plant material for Victorian arrangements:

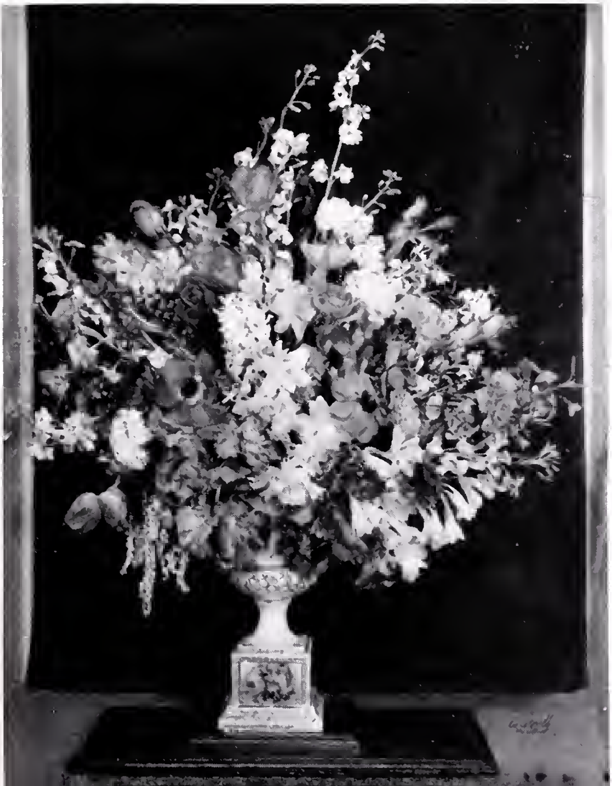
Acacia
azalea (*Rhododendron*)
goldentuft alyssum (*Alyssum saxatile*)
Amaryllis
Anemone
balsam (*Impatiens balsamina*)
bluets (*Houstonia*)
broom (*Cytisus*)
buttercup (*Ranunculus*)
Calendula
calla lily (*Zantedeschia*)
Camellia
Canterbury bells, blue and white (*Campanula medium*)
Christmas-rose (*Helleborus niger*)
cockscomb (*Celosia*)
Coreopsis
crape-myrtle (*Lagerstroemia*)
Dahlia
Daphne odora
foxglove (*Digitalis*)
geranium (*Pelargonium*)
Gladiolus
heliotrope (*Heliotropium*)
Hydrangea
jasmine (*Jasminum*)
lavender (*Lavandula*)
lilac (*Syringa*)
mignonette (*Reseda*)
Mimosa
morning-glory (*Convolvulus*)
primrose (*Primula*)
poppy (*Papaver*)
Rhododendron
rosemary (*Rosmarinus*)
snapdragon (*Antirrhinum*)
sweet pea (*Lathyrus odoratus*)
thistle (*Cirsium*)
Trollius
tuberose (*Polianthes*)
tulip (*Tulipa*)
wallflower (*Cheiranthus*)
yarrow (*Achillea*)
Zinnia

Victorian arrangement.



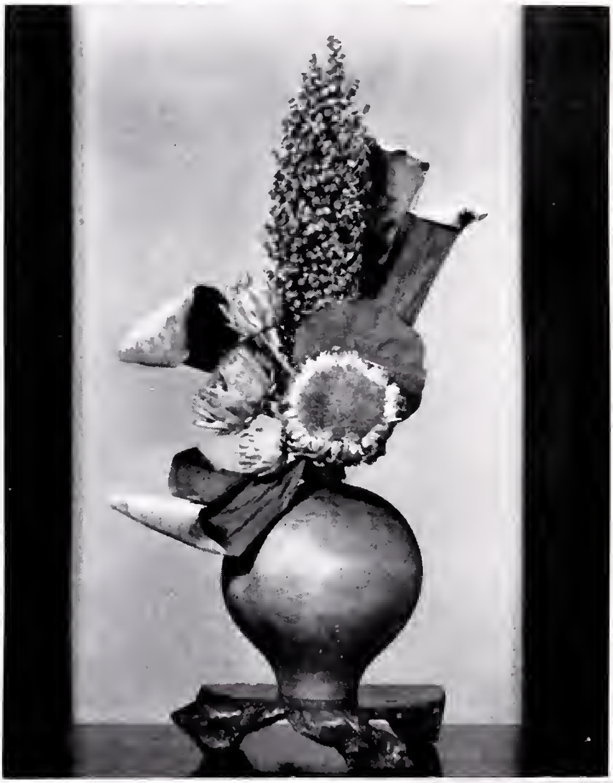
Arranged by Margaretta Davis *Meredith*

Arranged by Mrs. Edward L. Alexander *Boutrelle-Sevecke*



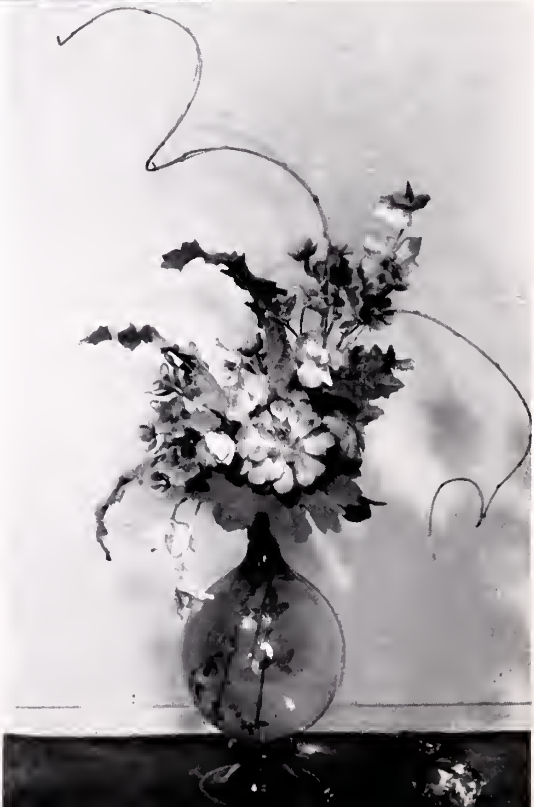
Arrangement in Williamsburg style uses hyacinths, ranunculuses, carnations, stocks, roses, parrot tulips, Dutch irises, narcissi, anemones, freesias, pieris, and ivy geranium foliage. Colors are repeated on antique hand-painted porcelain urn.

TWO CONTEMPORARY ARRANGEMENTS



Arrangement of dried tropical plant material.

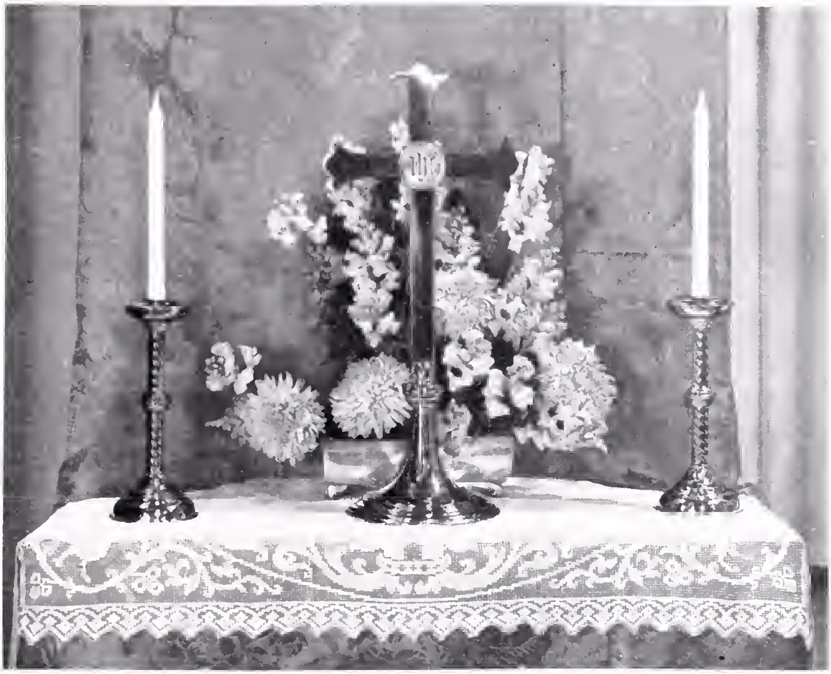
Arranged by Mrs. Homer Reed



Wisteria branches, acanthus leaves, houseleek (*Sempervivum*), barberry, and *Helleborus orientalis* in green glass bottle.

Arranged by Mrs. William C. Meissner

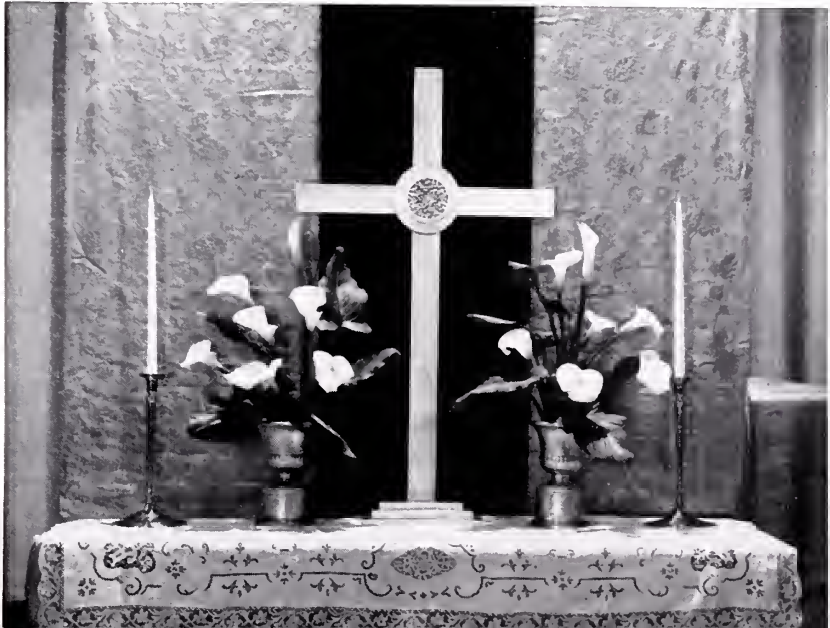
FLOWERS ON THE ALTAR

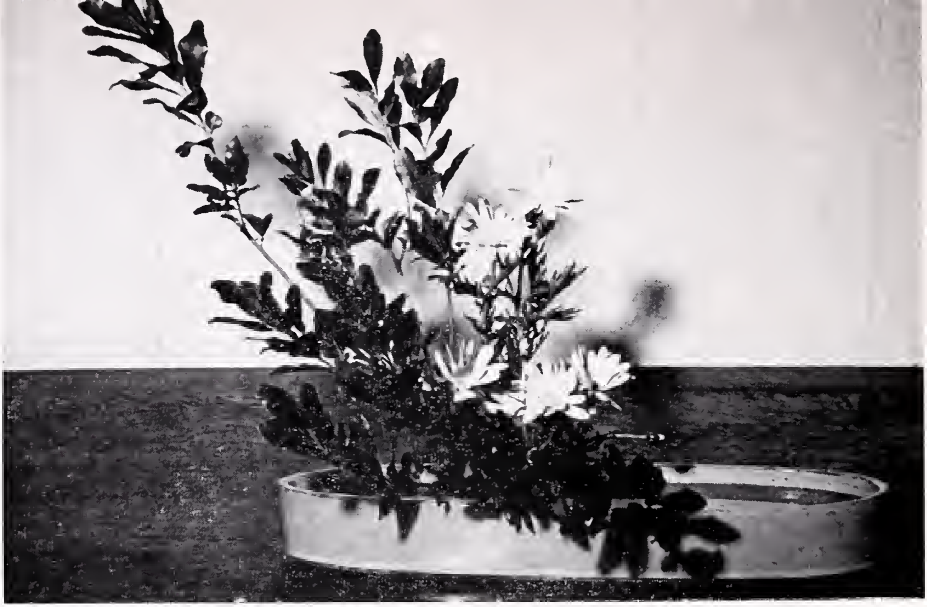


Arranged by Mrs. R. Wyld

Two arrangements for church altar; note that flowers should never be higher than cross.

Arranged by Mrs. W. Whitney *Boutrelle-Sevecke photos*





Arranged by Mrs. Haruko Akamatsu

Arrangement in Moribana style of Ikenobo school.

JAPANESE FLOWER ARRANGEMENT

Among the Japanese arranging flowers has reached the peak of refinement as an art and as an active influence in everyday life

Helen Jones

IKEBANA or Japanese flower arrangement is a fascinating study for those interested in learning the principles of beautiful line arrangements. Although there are many schools of Japanese floral art, they all follow the basic principles. The imaginary triangle is used as the skeleton form, the three points being symbolic of Heaven, Man, and Earth. The tallest line, Heaven, is usually one and one-half to two times the diameter of a low container or one and one-half to two times the height of a tall container. Man, the intermediate line, is about two-thirds the height of the tallest line, and Earth, the lowest, about one-third the height of the tallest line.

Balance and proportion are the two most important factors in any Japanese arrangement. Color is considered but is not as important as beauty of line. Each flower or branch used is an important part of the arrangement and is placed in a definite position in the holder.

Moribana Style

The Moribana style is a naturalistic arrangement placed in a shallow container with a needlepoint holder used to support the plant material. The Heaven line is placed upright in the holder with its tip over its base. The Man line is placed at an angle of approximately 30° from the Heaven line. The Earth line is placed approximately 45° from the Heaven line and always on the opposite side from the Man line. All lines should start at the same base. To this first group, other groups of different heights may be added, made up of lines of unequal length.

The arrangement may be made up of five lines instead of three by placing a line between the Heaven and Man branch and one between the Heaven and Earth lines.

An arrangement of Japanese flowering quince.

Arranged by Mrs. M. Arai *Hugelmeyer*

Tall arrangement of *Liatris*.

Arranged by Mrs. Natsuko Isonishi

Seven-line arrangements may be made by adding two additional lines between those added for the five-line arrangement.

Flowers in season are always used if possible and are placed so each tip points upward and never allowed to droop over the edge of the container.

Buds are symbolic of the future, full or perfect blossoms symbolic of the present, and dried blooms or leaves of the past.

In a Moribana arrangement, the amount of water placed in the container varies with the season—very full in the spring, one-half to two-thirds full in the summer, and almost empty in the fall and winter.

Two Classical Schools

Arrangements in the Enshu school, one of the classical schools, are noted for exaggerated curves. A split bamboo holder made to fit the container is used. Containers are usually bronze. The proper manipulation and placement of each line in the slotted bamboo is difficult to obtain

Arranged by Mrs. D. C. Jones *Boutrelle-Sevecke*

Podocarpus and red anthuriums.

and takes many hours of practice and patience. However, the results are worthy of the effort and to most admirers of the school this is the most satisfying kind of arrangement—a true example of the simple beauty of line.

The Ikenobo school, another of the classical schools, features simple severity of line. The stems or branches used are slightly curved and are placed to conform to the three basic lines, Heaven, Man, and Earth. A fork holder which is cut to fit the container and fitted into place is used. Tall bamboo or bronze containers are preferred; pottery containers are likely to crack if strain is used in wedging the fork into place.

The study of Japanese flower arrangement develops an appreciation of balance, proportion, rhythm, and line. After studying and learning the basic principles of this art, they can be applied to any type of arrangement, whether mass, line mass, or line in the American version. It also teaches restraint, which is difficult for most beginners in flower arrangement to learn. We learn that "in simplicity there is great aristocracy."

It is hoped that the reader of this brief outline will be prompted to study the art of Japanese flower arrangements from some of the many fine books which are now available on the subject.

Arrangement of broom (Cytisus) shows exaggerated curves which characterize the Enshu school.

Arranged by Mrs. John C. Graham
Robert E. Swenson studios

FLORAL PICTURES FROM YOUR GARDEN

How to make beautiful "flower prints" from pressed plant material

Ruth Voorhees Booke

NOTHING so dramatically demonstrates the withering effect of time's passage as the swiftly dying flower. How often do we wish when looking at fresh flowers that their beauty could be retained. It can be, for by carefully pressing and drying the plants and putting them under glass, their beauty may be enjoyed for many years. Plant preservation is an art, and it has been said that no photograph or colored plate, however lovely, can ever equal the value and interest of a real plant naturally and colorfully preserved.

Pressed flower pictures are by no means new, for such work was done years and years ago and this is just the revival of a very old art. Passepartouts and lampshades of pressed plant material were made long before our time.

The art did not originate in this country but perhaps in some European country or maybe in Egypt.

Collecting Material

The best time to gather material is in the middle of the day when the sun has evaporated all surface moisture. Flowers should be picked just before they have reached their maturity, then they will keep the maximum color after they have dried. But also always pick some blossoms in various stages of development for variety, and take plenty of their foliage. The cycle of seed to flower and back again to seed is most interesting and so let us make the most of it. Press the plants as soon as possible after picking. Fleshy or thick-stemmed flowers do not press and dry well. Neither do flowers with textures like lilies, nasturtiums, petunias, poppies, passion flower, etc., although it is possible to be successful with these if great care is taken.

Pressing

When ready to press the material, have at hand folded sheets of newspaper, magazines, and two flat boards.

Arrange the plant material between the newspapers in the position you wish to have it dry. Then slip these papers between the pages of a magazine. Leave several pages before putting in the next specimen, and repeat until the magazine is filled. When all is finished place the magazine or magazines on one board and the second board on top, weighing it down with something heavy.

The papers should be changed frequently since no good can result from leaving the material between damp drying papers. Dampness turns white flowers brown and mildew quickly makes its appearance.

The length of time for drying depends on the thickness of material and the atmospheric conditions. The faster they dry the better the color—it usually takes from 3 to 10 days. Store all pressed material in a cool, dry place until it is to be used.

Frames and Backgrounds

A great variety of frames and backgrounds are used for mounting preserved material. The background is cut to fit the frame, then the dried material placed on it to make a pleasing composition. The picture is covered carefully with the glass and then the frame put over it and the back firmly secured with nails. Unless the picture is a very large one, I rarely use glue. Pressure against the glass holds material to the background.

Preserving nature's beauty for years to come can be a fascinating hobby. It can also be of great value for many invalids as one kind of occupational therapy.

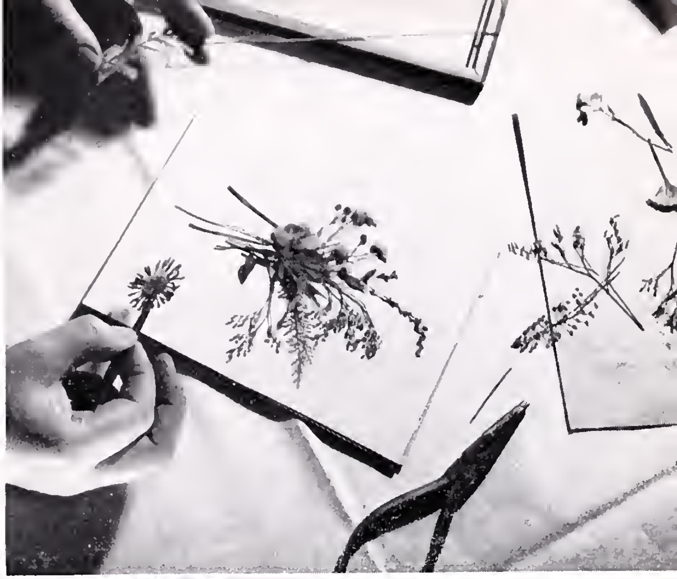
Flowers to be pressed are placed between sheets of newspaper.

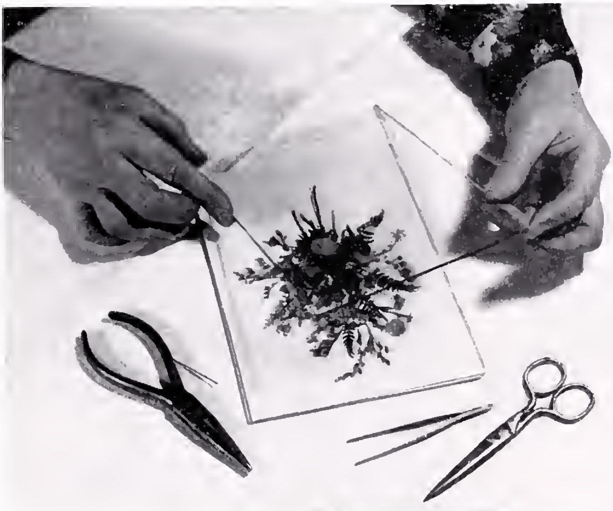
Papers containing flowers are placed between pages of magazines or between extra newspaper sheets, piled up, placed between boards, and weighted.

Photos courtesy Three Lions, Inc.

When dry, flowers are removed from papers and stored in cool dry place until needed.

Dried flowers are arranged on background.

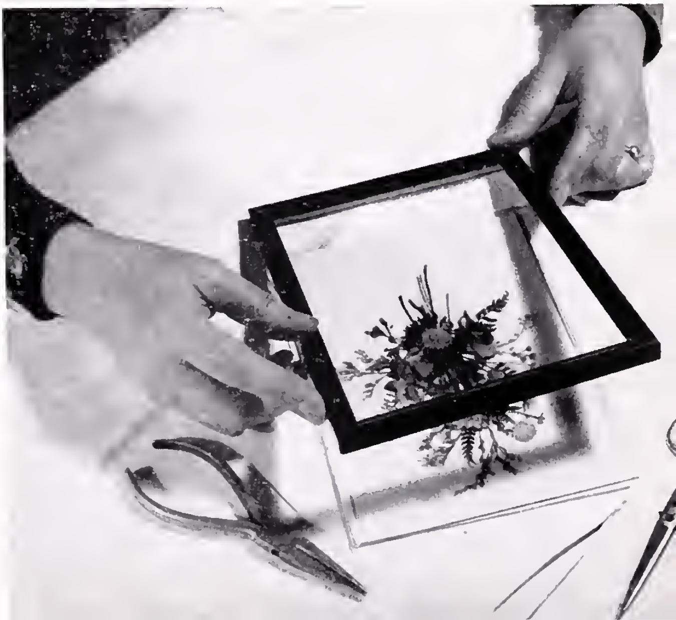


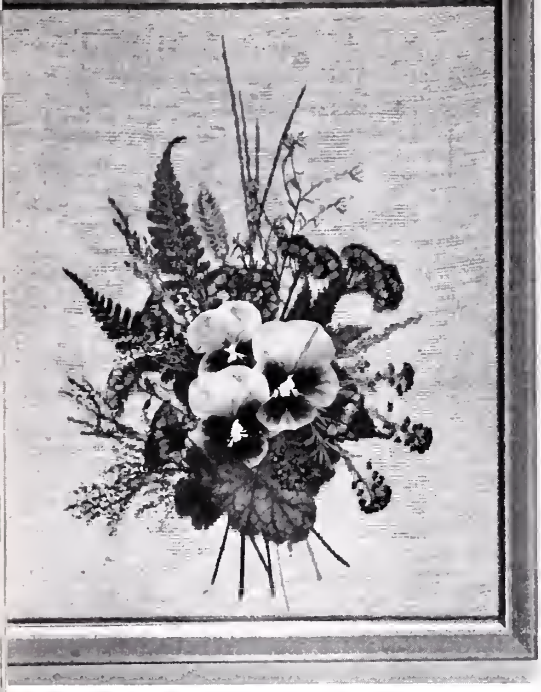


After arrangement is completed, glass is carefully laid on it.

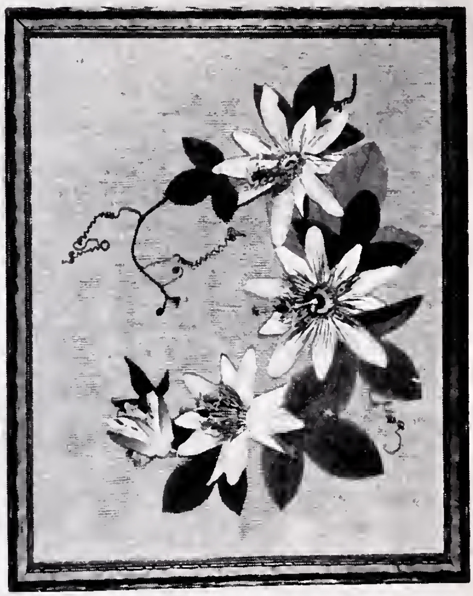
Photos courtesy Three Lions, Inc.

Frame is put on and arrangement is finished. Pressure of backing against glass holds flowers in place.



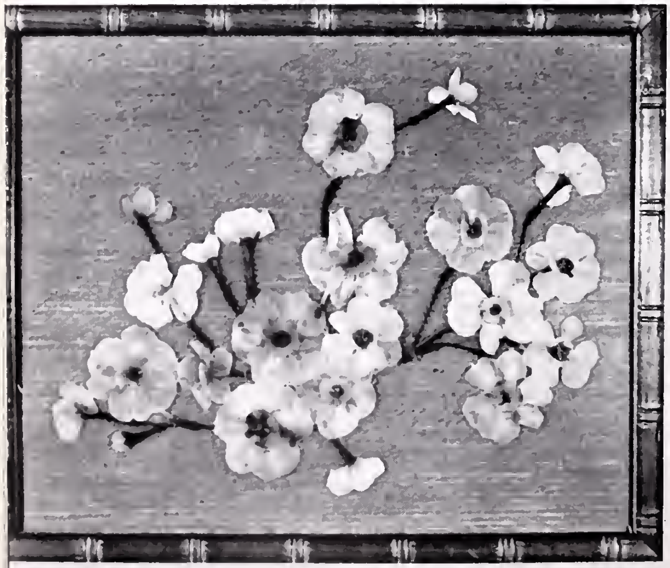


Delicate picture by Mrs. Booke features purple pansies, ferns, ageratum, alyssum, and grasses on green background.



Passion flowers and their foliage produce bold, striking design.

Buhle photos



Narcissus flowers in arrangement suggesting an Oriental print.

MAKING A CORSAGE

Step-by-step instructions for making a basic but beautiful corsage of roses

Bennie P. Hubbard

NOTHING in nature rivals the charm and beauty of a fresh flower—so, since early times, our ladies have availed themselves of these colorful and fragrant beauty supplements for adornment.

The earlier methods of assembling a bouquet were very simple. Flowers were merely clustered and tied with a piece of cord or ribbon. These clusters were necessarily on the bulky side and could more easily be attached to the waist (or corsage), hence the "corsage bouquet."

Even until about 25 years ago a corsage was for the waist or bodice and there was a smaller, lighter version which was worn flatteringly near the face called a "shoulder bouquet." Now we use the term "corsage" as a blanket description covering arrangements worn in several different ways.

With the introduction of various construction materials such as wire, tapes, and the like, we have been able to fashion flowers for wear in the form of hats, hair arrangements, earrings, necklaces, leis, wristlets, and many other floral accessories.

In corsage make-up there are several things to be considered. A color should be selected which will be pleasing against its background and the corsage should be fashioned to be as light as possible and look as if it were a part of the line and design of the dress.

The simplest form of corsage is the "tailored nosegay." This is for informal wear and is usually a simple cluster of flower heads with their own stems showing below and perhaps a touch of their own foliage; no ribbon is used. Carnations, violets, and certain other flowers lend themselves to this type of construction.

Flowers which do not lend themselves to a very tight cluster may be "tailored" by making a neat grouping of the wired and taped units and adding a touch of fresh foliage.

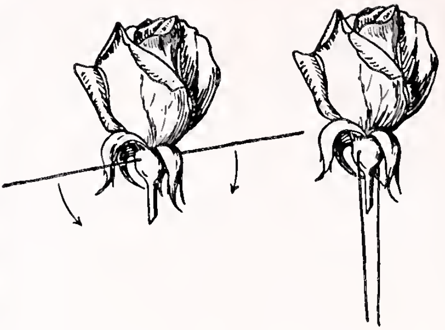
Corsages for evening wear are often more elaborate and may be fashioned in one of many types depending upon the style of gown and the manner in which the flowers might be worn most becomingly.

I think my favorite creation in this field is the corsage which is explained on the following pages. Roses were selected because they are too often seen in corsages which resemble miniature funeral sprays. This corsage has no such resemblance and may be worn in any of several positions very effectively.

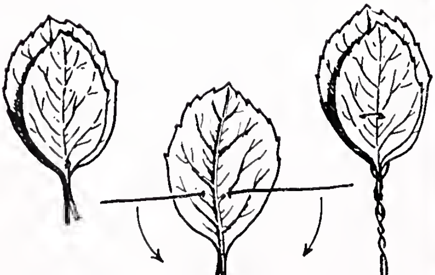
MATERIALS USED IN MAKING ROSE CORSAGE

21 gauge wire (cut in 18-inch pieces)
26 gauge wire (cut in 18-inch pieces)
A commercial stem wrapping such as Floratape, Parafilm, or Stemwrap
Ribbon
Roses and their foliage

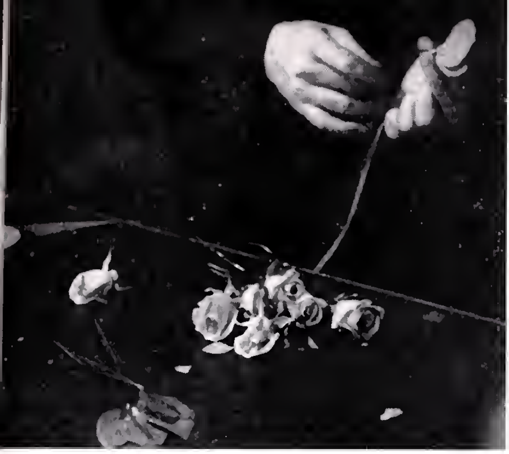
STEPS IN MAKING THE CORSAGE



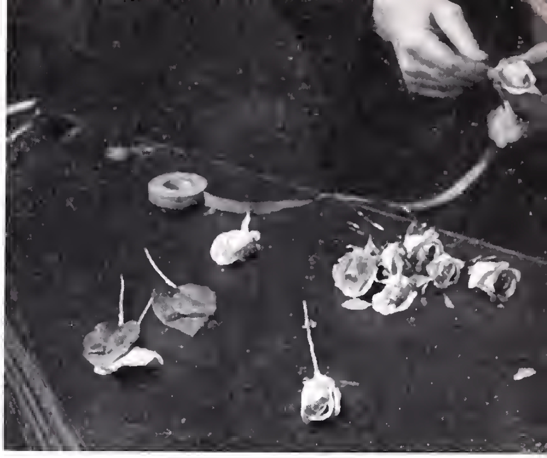
Roses are cut off with slanting cut ½ inch below base of flower (receptacle). Wire (21 gauge) is pressed through base until rose is in center. Wire is bent down until two halves are parallel, but not twisted.



Two leaves are wired together for strength. Lighter wire (about 26 gauge) is stuck through leaves about 1 inch from bottom. Ends of wire are bent down and twisted around one another and around stems of leaves.

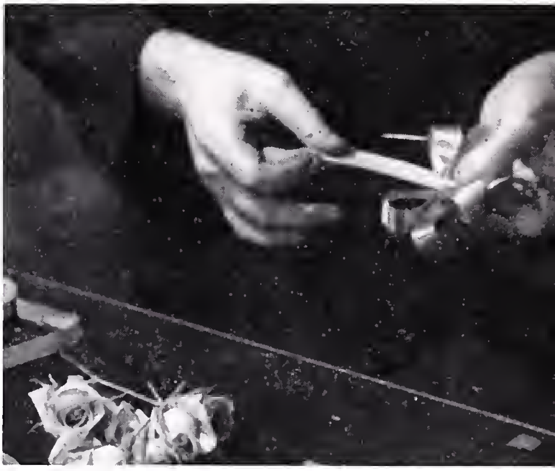


Wires and stems of leaves are taped with commercial stem wrappings.



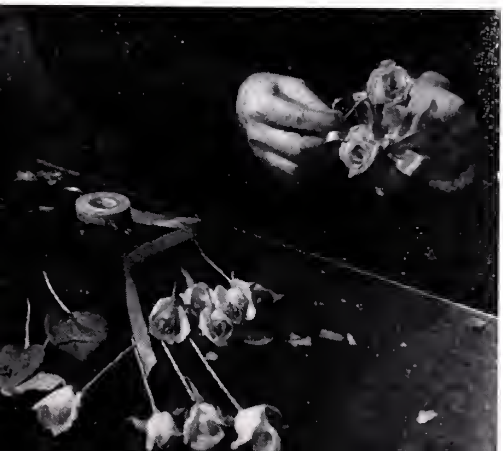
Wires and bases of flowers are taped, beginning just below cut stem, working up over base of flower, and back down to end of doubled wire.

Ribbon bow is gathered and secured at center with one of the heavier wires. Bring ends of wire down to form stem. ⟶

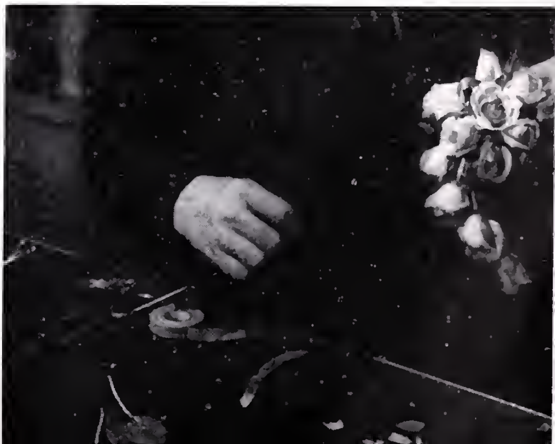


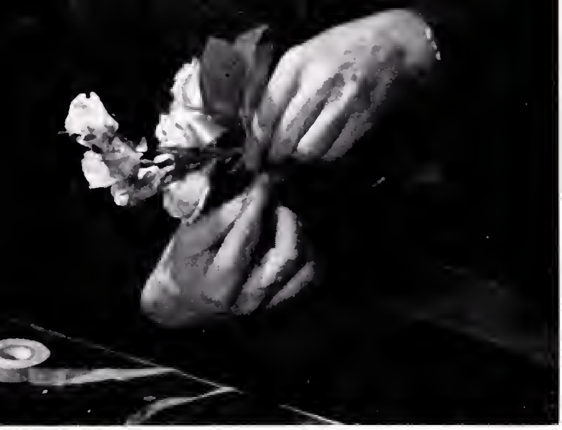
Boutrelle-Sevecke photos

Corsage is begun by tucking wired roses into bow in such a way that loops of bow intermingle with flowers.



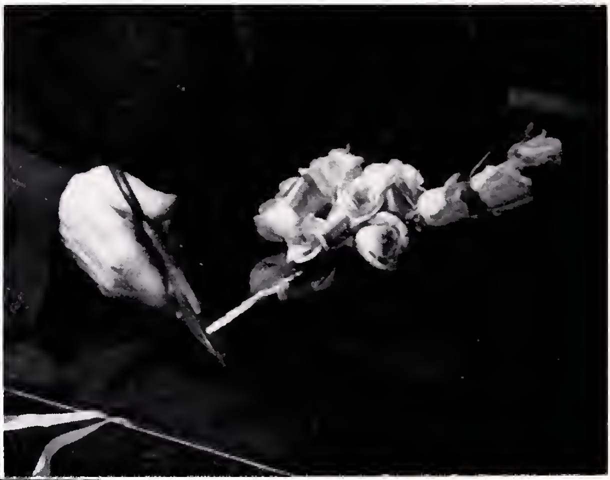
Last two or three roses are so placed that they form graceful curving garland extending from cluster.

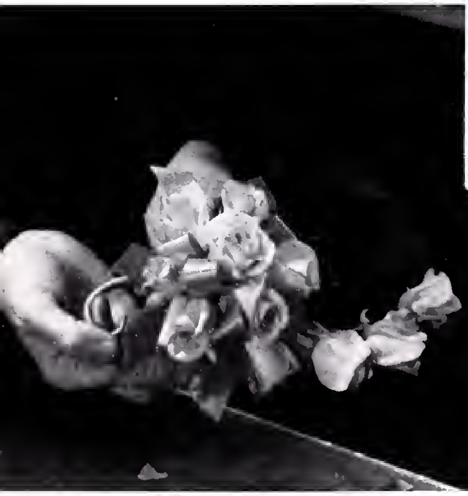




Wired leaves are fastened at back of cluster so that they radiate from center of bow.

Ends of wires are taped together or wrapped in ribbon and cut off about 4 inches from center of cluster.

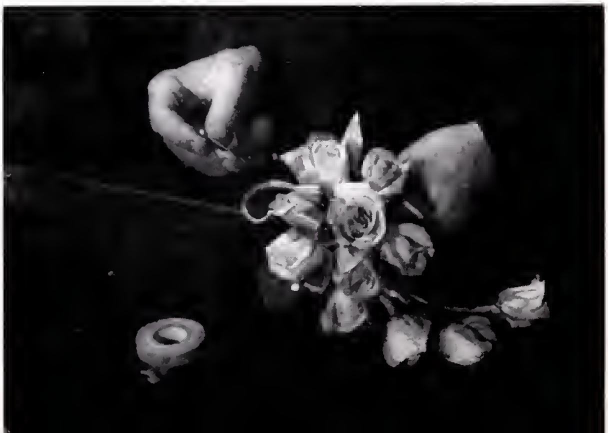




Wrapped wire "stem" of corsage is curved into scroll complementary to curve of extending garland of roses.

Boutrelle-Sevecke photos

Corsage is completed by addition of pearl-headed pins for fastening.



DRYING PLANT MATERIAL FOR WINTER BOUQUETS

How to preserve berries, flowers, and leaves for dried flower arrangements

Ruth Voorhees Booke

TO DRY plant material for winter bouquets different methods are used for various materials.

Leaves, Ferns, and Grasses

Leaves and ferns are laid between sheets of newspaper, flat on the floor in a dark dry place (an attic is ideal) with a board placed on top of them to keep them smooth and flat.

Grasses may be dried in the same manner or hung in small bunches in attic or closet. It is interesting to gather them in the various stages of their development, but never past their prime. Grasses may also be dried in an upright position in a container to encourage graceful curves.

Hanging in Bunches

Rose, bittersweet (*Celastrus*), mountain-ash (*Sorbus*), smoke tree (*Cotinus*), dock (*Rumex*) [green], bush-cranberry (*Viburnum*), sumac (*Rhus*), milkweed (*Asclepias*), honesty (*Lunaria*), poppy (*Papaver*) [cut when green], *Baptisia*, *Yucca*, *Althaea* [cut green], columbine (*Aquilegia*) [cut green], and lilac (*Syringa*) are but a few of the plants whose pods and berries may be hung in bunches to dry.

Flowers that will dry hanging in bunches are *Celosia*, joe-pye weed (*Eupatorium purpureum*), goldenrod (*Solidago*), statice (*Armeria*, *Limonium*), strawflower (*Helichrysum*), globe amaranth (*Gomphrena globosa*), baby's breath (*Gypsophila*), sea lavender (*Limonium*), mullein (*Verbascum*), and many others. They must be cut in their prime.

Sand Method

The sand method of drying flowers is an excellent way to obtain that much desired third dimension. It is one of the oldest used in drying flowers. Fine white seashore sand is excellent for this but all salt must be leached from it.

Hydrangea, rose, marigold (*Tagetes*), *Zinnia*, black-eyed susan, (*Rudbeckia hirta*), *Delphinium*, *Salvia*, daisy (*Chrysanthemum leucanthemum*), pansy (*Viola tricolor hortensis*), *Gladiolus*, carnation (*Dianthus*), and *Anemone* look almost fresh after all moisture has been absorbed by sand drying, but they are quite fragile in texture.

Have in readiness a cardboard box that has holes in the bottom; cover holes with paper or cardboard. Put about an inch of sand on the bottom, then place flowers head down on the sand and carefully pour more sand over them until they are well covered. Put only one layer of flowers to a box. Allow them to remain in a dry place from 10 days to 3 weeks. After the drying, pierce holes in the bottom of the box to allow sand to run out. The flowers will then be ready for you to arrange. Almost all flowers may be dried by this method.

Baking Method

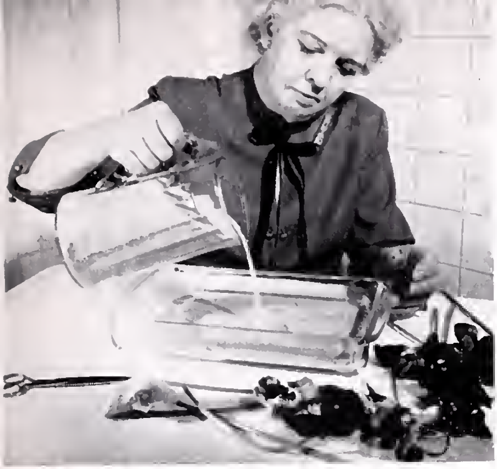
The baking method is another way to preserve and dry plant material. The bottom of a shallow baking pan may be covered with sand, then the flowers placed on the sand and covered well with more sand. The containers are placed in an oven for about an hour with lowest possible heat. I do not care for this method as it makes the flowers too brittle.

First step in sand method of drying is to place flowers head down on layer of sand in container. As mentioned in article, cardboard box is more convenient than kettle shown here, as sand can be readily removed without disturbing flowers by poking holes in bottom of box.

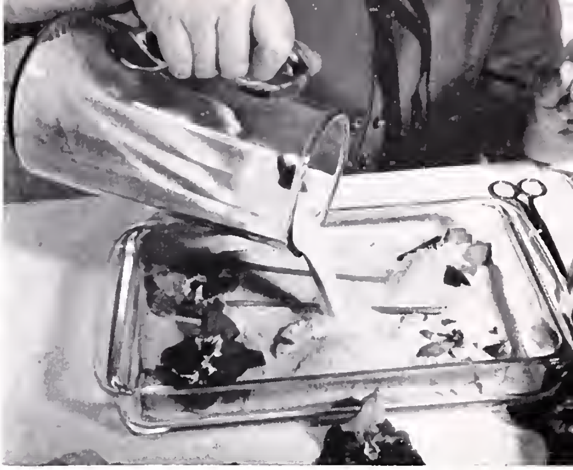
Sand is poured around flowers until they are completely covered. Container is then left in dry place for 10 to 21 days. At the end of this time flowers will be dried.

When dry, flowers are carefully removed from sand and any grains sticking to them removed. Care must be exercised in handling them as they are quite brittle.

Dried flowers are used in making arrangements just as fresh ones are, but greater care must be used in handling them.



In baking method of preserving flowers, layer of sand is first poured into baking dish.



Flowers are carefully laid on sand and covered completely with more sand. (*Above, right*)

Flowers are dried for about an hour in oven at lowest possible heat. When dried, they can be used just as those dried by other methods.

Photos courtesy Three Lions, Inc.

Borax Method

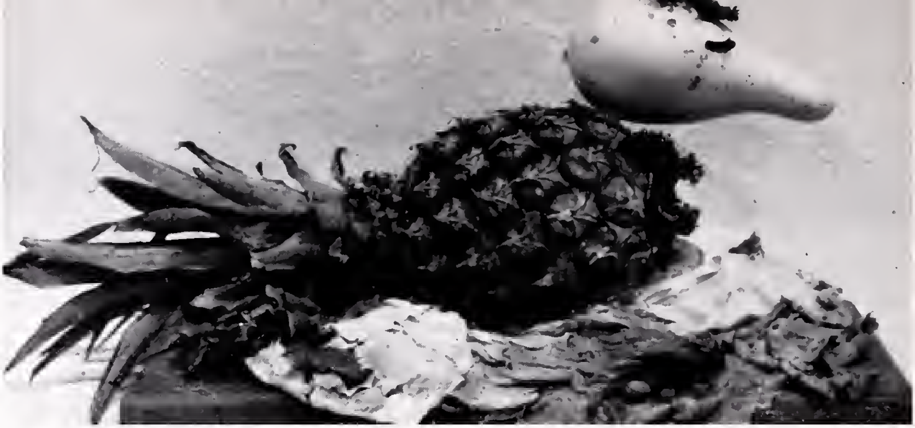
The straight borax method does not seem satisfactory to me, but a combination of borax and corn meal is good. Mix 1 part of borax and 6 parts of white corn meal and proceed in the same manner as for the sand method in the cardboard box. The corn meal and borax mixture may be saved and used over and over.

Glycerin Method

For drying magnolia leaves, oak leaves, the lovely tinted maple leaves in the fall, and also beech leaves which many consider the loveliest and most useful of all foliage material, the glycerin method is good. Cut the foliage while crisp and fresh, crush about 2 inches of the stem ends with a hammer, this for easy absorption, then stand branches in a solution of equal parts of glycerin and water for about 2 weeks. At the end of this time they will be ready for use. You will be delighted with the fine glossy, fresh appearance.

Making Dried Flower Arrangements

When making dried arrangements the same principles are used as in making arrangements with freshly cut plant material. Greater care must be taken because of the fragility of dried plants but material that has been carefully dried will make very colorful and beautiful winter arrangements.



Arranged by Stuart Rogers

Pineapple duck with small summer squash head and clove eyes swims on lettuce leaf waves.

Children created this

VEGETABLE ZOO

Youngsters can handle any type of flower arrangement, but excel at making decorative animals from plant materials

Dorothy C. Kemble

AFTER seven years of working with juniors, ages 4 to 18, and judging their flower shows, I find that children can make any type of flower arrangement from miniatures to table settings and shadow-box displays. But there is one type of design that is strictly a junior invention. No adult could produce the entries found in a class of "Animals Made from Vegetables and Fruit."

Materials

Whether they are made for a flower show, a Thanksgiving table, or just for fun, the chief ingredient of these animals is imagination. The first step in making them is to take the children to the supermarket or vegetable stalls. Let them select their own shapes and colors. The second step is to provide a good work table, a generous supply of toothpicks, and a pair of kitchen scissors. Of course the type of animal that results depends primarily on its purpose. If it is for a flower show, the title of the class will determine the kind of animal. "Down on the Farm," for instance, brings forth mostly domestic animals; but "Animals from Mars" allows the most wonderful flights of imagination.

Construction

How are these animals made? Simply by combining vegetables, fruits, or cut-out parts of them. To make a pineapple goose like one seen at a recent show, a fresh pineapple with a good long top is turned on its side. Then a zucchini squash with just the right curve is fastened with toothpicks to a slightly hollowed place in the top of the pineapple. Raisins may be used for eyes and a row of cloves or raisins for a crest on the back. A piece of red pepper makes the bill. If a duck is preferred, a small summer squash can be used horizontally instead of the zucchini.

Eggplant works out beautifully for the body of an elephant or rhinoceros. For the elephant, a turnip makes the head and trunk. Carrots are added for legs and a scallion for the tail. The elephant is given a circus touch with a ruff of kale and a saddle of red pepper decorated with scallion rings.

Arranged by Charlotte Radley *Boutrelle-Sevecke photos*

Eggplant elephant has carrot legs and parsnip head; red pepper saddle and green kale ruff give him festive circus touch.

For Peter Rabbit, a butternut squash is topped by a green pepper head with pea-pod ears and eyes of prunes. Cut acorn squash forms the fore-legs and cut summer squash the hind ones.

For the Pagliacci-looking mouse, a turnip with a long tail has a small potato for a head, legs and nose of small, uncooked prunes, and ears of big, cooked prunes.

The pictures shown here are of prize-winning animals in the Junior Section of the Federated Garden Clubs of New York State exhibit at the International Flower Show. But local flower shows all over are producing others just as imaginative. Why not have your youngsters make some for a party table? Or just for fun on a rainy day?

Turnip mouse.

Peter Rabbit.

EXOTIC "FLOWERS" FROM COMMON PLANT MATERIAL

Have fun making beautiful, long-lasting flowers from ordinary leaves and stems

Dorothy Aldrich

Drawings by Gen Young

DO YOU ever get tired of the work that goes into keeping a flower arrangement fresh and nice-looking? If you have spent much time with this problem you know that the longest you can possibly hope for an arrangement to last is about 2 weeks. And this length of time is achieved only by very careful selection and handling of materials.

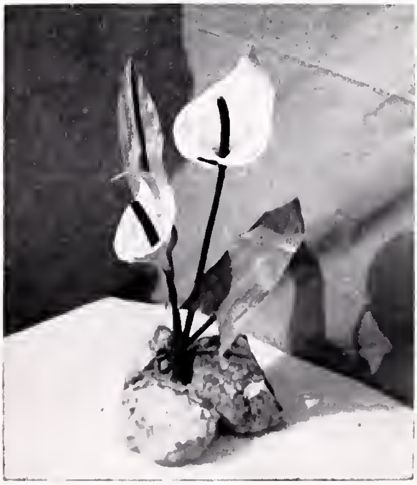
The average fresh plant material is worthless after 3 days and then you have to spend time and money to create another arrangement. Quite often the flowers desired are out of season, unobtainable, or so expensive as to be prohibitive. This is usually true through late fall and winter. And that is the time when, if you have been forehanded and gathered a few commonplace and easy-to-find mateirals, you can have lots of fun making your own flowers.

Each flower is designed and made for the specific place where it will proudly stand in its arrangement for several months or longer if you wish. When you tire of it, the whole arrangement may be put in a box to be stored for the summer and brought out again the following winter; or it may be taken apart and the material used over again in a new design —whichever way you wish.

To help make the flowers and possibly to start you on a fascinating treasure hunt for more materials to work out these and other ideas, the following "how-to-do" pages were planned.

All leaves are rendered more pliable and less brittle by being given a light coat of glycerin when first picked. This is more or less absorbed in the drying process. Any excess may be wiped off with a tissue or soft cloth.

CALLA LILY

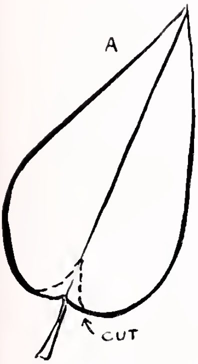


MATERIALS:
PHILODENDRON LEAF
CAT-TAIL (SLENDER)
CORN LEAVES OR
ASPIDISTRA
DRACENA
#18 FLORISTS WIRE
FLORAL TAPE

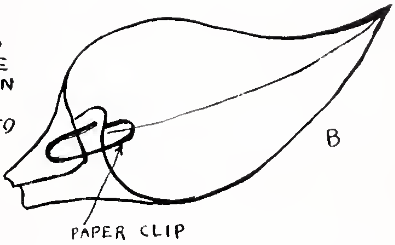
NOTE:
PHILODENDRON LEAF IS MORE PLIABLE IF USED HALF-DRY. PICK LEAVES SEVERAL DAYS BEFORE USE. CAT-TAIL IS USED DRY.

STEP 1.

PREPARE LEAF



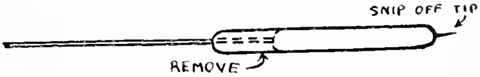
CUT LEAF AS SHOWN. (A) BRING 2 BOTTOM CORNERS OF LEAF UP TO FORM CONE SHAPE (B). HOLD IN POSITION WITH PAPER CLIP OR CLIP CLOTHES PIN TILL READY TO ASSEMBLE.



STEP 2.

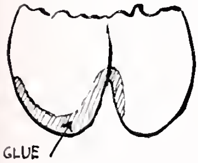
CAT-TAIL SPADIX

USE SLENDER CAT-TAIL - ½" DIA. MAXIMUM. MEASURE ⅔ THE LENGTH OF THE PHILODENDRON LEAF AND MAKE THE CAT-TAIL THIS LONG BY SCRAPING BROWN FUZZ FROM REST OF STEM. LEAVE 1" OF SCRAPED STEM - CUT OFF REST. FORCE A LENGTH OF #18 FLORISTS' WIRE UP INTO 1" STEM. WITH FLORAL TAPE WRAP STEM AND WIRE.



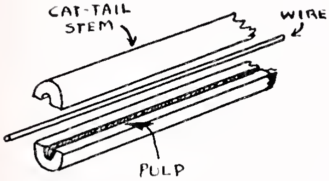
STEP 3.

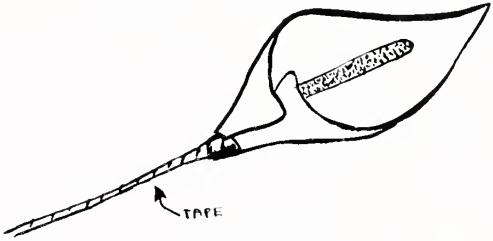
ASSEMBLE FLOWER AND MAKE LEAVES



APPLY DUCO CEMENT TO LEAF AS SHOWN AND SHAPE LEAF AROUND CAT-TAIL. PUT PAPER CLIP BACK ON LEAF TILL GLUE DRIES.

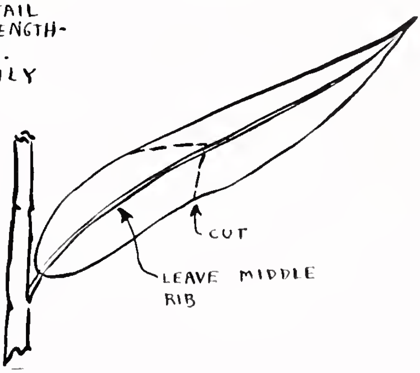
WHEN GLUE IS DRY TAPE BOTTOM OF LEAF AND CAT-TAIL TOGETHER WITH FLORAL TAPE, AND CONTINUE TAPE DOWN FULL LENGTH OF STEM.



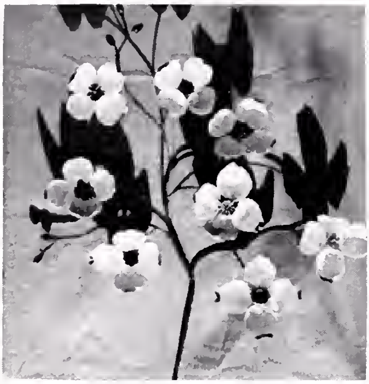


TO MAKE STEM OF LILY HEAVIER TAKE CAT-TAIL STEM THAT WAS CUT OFF, SLIT IN HALF LENGTHWISE, AND REMOVE PULP FROM CENTER. PUT 2 HALVES AROUND WIRE STEM OF LILY AND WRAP WITH FLORAL TAPE.

FOR LEAF, CUT CORN LEAF AS SHOWN. ADD THICKNESS TO LEAF STEM IN THE SAME WAY AS LILY STEM WAS DONE. PAINT CALLA WHITE IF DESIRED.



DOGWOOD



MATERIALS:

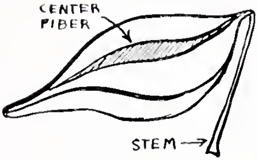
1. MILKWEED PODS
2. CENTERS FOR FLOWERS:

ACORN CUPS
ANNUAL POPPY SEED - BUTTON
LARCH CONE - MEDIUM SIZE
WHITE SPRUCE CONE - SMALL TIP
SWAMP GRASS BLOSSOM - CLUSTER
WILD BERGAMOT - DRIED FLOWER CENTER

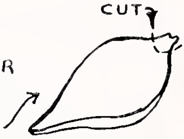
NOTE:
MILKWEED PODS MUST BE PICKED IN THE FALL WHEN THEY ARE DRY ON THE PLANT. SELECT SMALLER AND WIDER PODS FOR MAKING DOGWOOD FLOWERS.

STEP 1.

PREPARE PODS



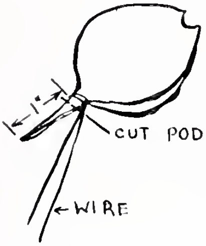
4 MILKWEED PODS = 1 DOGWOOD FLOWER. SELECT PODS ENOUGH TO MAKE THE NUMBER OF FLOWERS YOU WANT. REMOVE STEMS AND SOFT CENTER FIBER FROM PODS. TRIM STEM END OF POD AS SHOWN HERE. NOW PUT ALL THE PODS IN A WET TOWEL TO ABSORB MOISTURE AND LET STAND UNTIL PLIABLE - ABOUT ½ HOUR.



STEP 2.

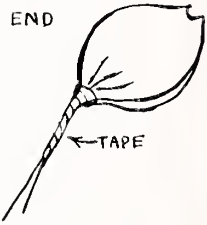
ASSEMBLE FLOWER

MATERIALS: BROWN FLORAL TAPE
#18 + #22 FLORISTS' WIRE
FINE SPOOL WIRE - COTTON COVERED

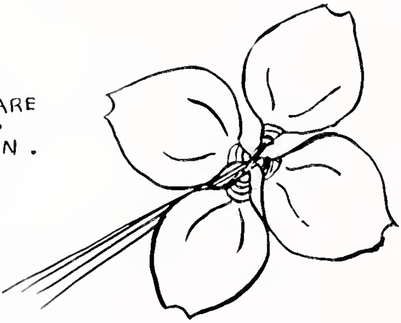


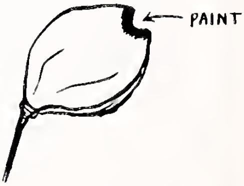
CUT A 6" LENGTH OF SPOOL WIRE. GATHER POINTED END OF POD AND SECURE FIRMLY WITH WIRE. CLIP OFF END OF POD CLOSE TO WIRE. WIRE ALL PODS THIS WAY.

USE BROWN FLORAL TAPE TO COVER END OF POD AND ABOUT 1" OF STEM WIRES.



WHEN ALL POD STEMS ARE TAPED, TAKE 4 PODS AND GROUP AS SHOWN.





HOLD AN EIGHT INCH PIECE OF #22 FLORISTS WIRE WITH THE POD STEMS AND TAPE ALL TOGETHER WITH FLORAL TAPE FOR FULL LENGTH OF WIRE.

ASSEMBLE REMAINING PODS INTO FLOWERS. PAINT INSIDES OF PODS WITH FLAT WHITE WATER PAINT. LEAVE OUTSIDES NATURAL.

WHEN WHITE PAINT IS DRY, BRUSH EACH PETAL TIP LIGHTLY WITH FLAT BROWN PAINT.

LET FLOWERS DRY THOROUGHLY.

STEP 3.

CENTERS AND ASSEMBLING BRANCHES

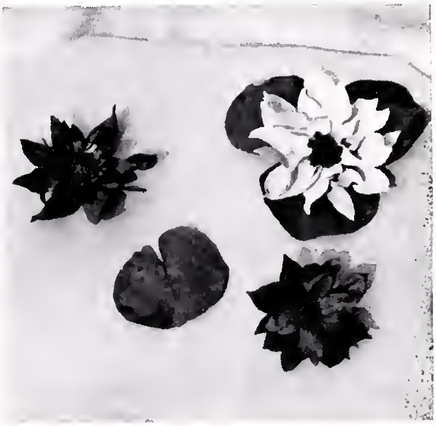
CENTERS ARE SIMPLY GLUED INTO PLACE. THESE CAN BE ANY OF THE ITEMS LISTED IN THE MATERIALS LIST, AND THEY CAN BE PAINTED OR USED IN THEIR NATURAL COLOR.

FINALLY, USING FLORAL TAPE, ASSEMBLE INDIVIDUAL FLOWERS INTO BRANCHES AS SHOWN IN PHOTO. FOR THIS, USE #18 FLORISTS' WIRE TO GIVE STRENGTH AND TO MAKE BRANCH LOOK HEAVIER.

WATER LILY

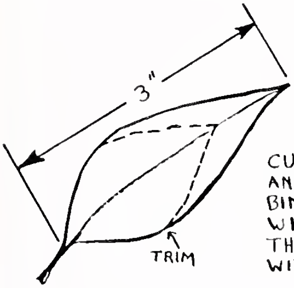
MATERIALS:

LEAVES FROM LIGUSTRUM - OR
ALTERNATIVES - LAUREL
ANDROMEDA
LEUCOTHOE
YELLOW STRAW FLOWER
SEA GRAPE LEAVES
PICTURE CORD WIRE
FLORAL TAPE



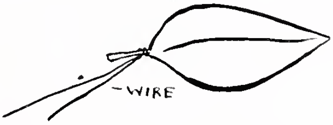
STEP 1.

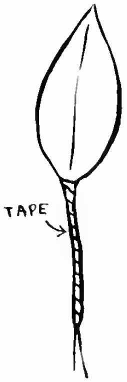
PREPARE LEAVES



TRIM 6 LEAVES FOR CENTER PETALS TO ABOUT 1½" AS SHOWN. TRIM 6 LEAVES 2¼" LONG FOR NEXT ROW OF PETALS. OUTSIDE ROW IS MADE FROM 9 UNTRIMMED LEAVES (3" TO 4" LONG). IF TIPS ARE TOO POINTED THEY CAN BE TRIMMED SLIGHTLY.

CUT A 6" PIECE OF PICTURE CORD WIRE AND SEPARATE THE INDIVIDUAL STRANDS. BIND THE STEM OF EACH LEAF FIRMLY WITH ONE OF THESE STRANDS AS SHOWN. THEN WRAP STEM AND WIRE NEATLY WITH FLORAL TAPE.

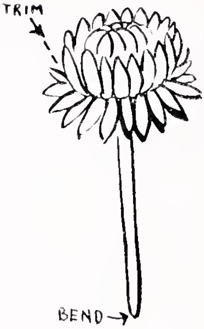




AFTER ALL THE LEAVES ARE WIRED AND TAPED PAINT THEM WITH FLAT WHITE WATER PAINT. OTHER COLORS MAY BE USED. THEY MAY BE PAINTED ON BOTH SIDES, OR ONLY ON THE TOP LEAVING THE UNDER SIDE NATURAL. THEY MAY ALSO BE LEFT COMPLETELY IN THE NATURAL LEAF COLOR.

STEP 2.

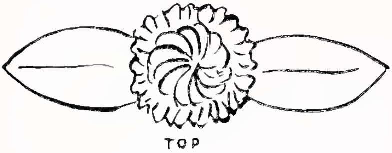
CENTER



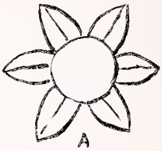
CENTER IS MADE FROM A YELLOW STRAW FLOWER APPROXIMATELY 2½" DIA. TRIM BOTTOM PART OF FLOWER AWAY AS SHOWN, MAKING A SMALLER FLOWER. IF STRAWFLOWER HAS BEEN PURCHASED, IT WILL HAVE A WIRE STEM. BEND WIRE BACK UP SO THAT FLOWER APPEARS TO HAVE 2 WIRES COMING FROM IT. THEN USE FLORAL TAPE TO WRAP THE 2 WIRES TIGHTLY TOGETHER.

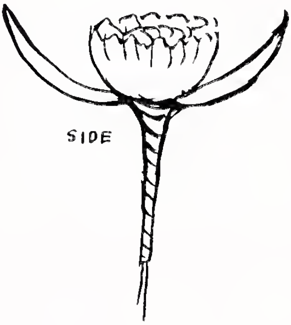
STEP 3.

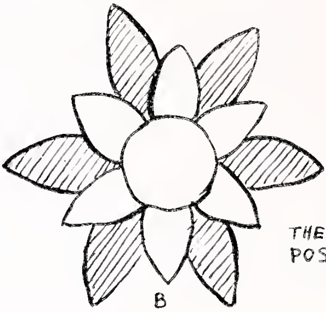
ASSEMBLE FLOWER



TAKE STRAW FLOWER CENTER AND TAPE 2 OF THE 6 SMALL LEAVES TO IT AS SHOWN. THEN SPACE OTHER 4 LEAVES THUS ↓ (A) TAPE INTO POSITION



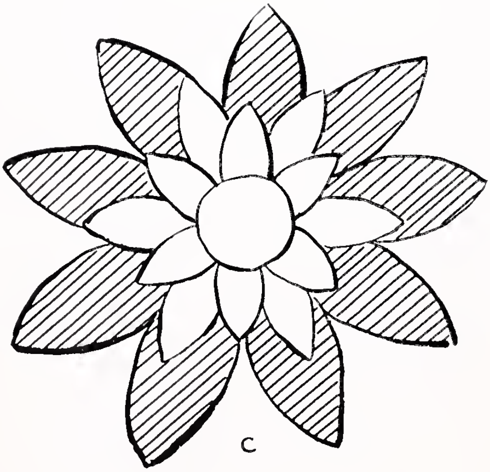




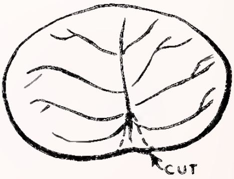
SPACE THE 6 MEDIUM SIZED LEAVES AS SHOWN AND THEN TAPE THEM INTO POSITION. (B)

SPACE THE 9 LARGE LEAVES AS SHOWN AND TAPE THEM INTO POSITION. (C)

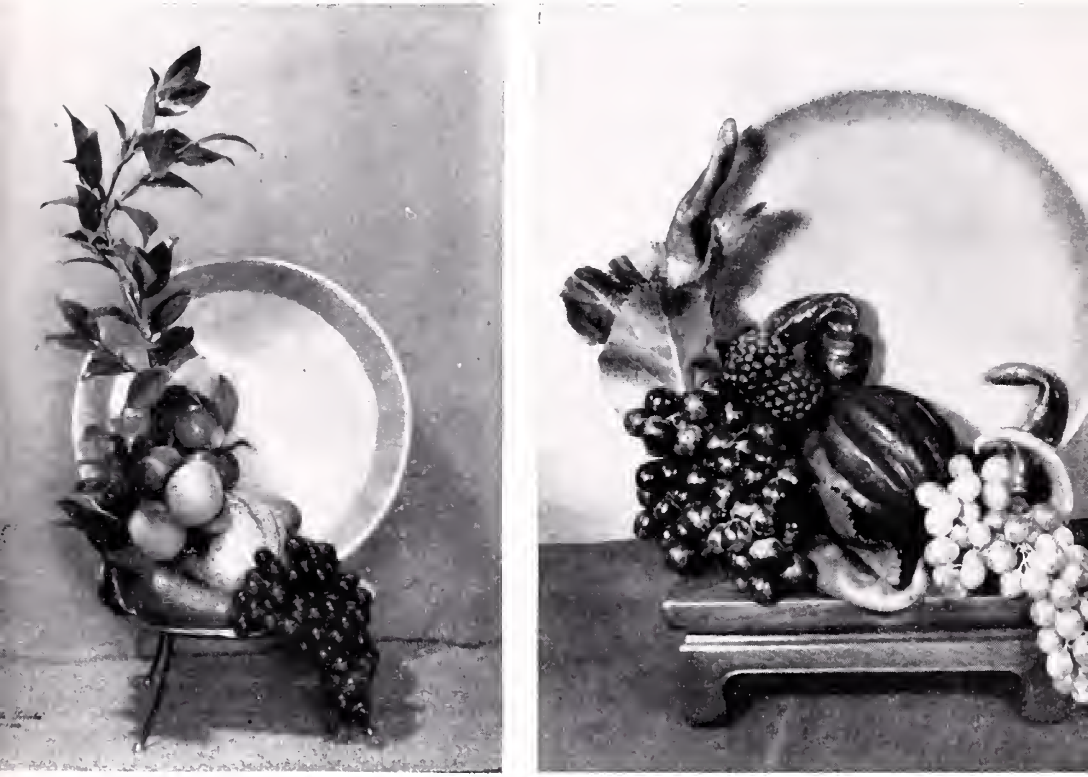
CUT STEM OF LILY SHORT OR CURL AROUND UNDERNEATH.



FOR LILY PADS USE SEA GRAPE LEAVES - JUST CUT A SLIT OUT OF STEM END TO SIMULATE LILY PADS.



FRUIT ARRANGEMENTS FOR FESTIVE DAYS

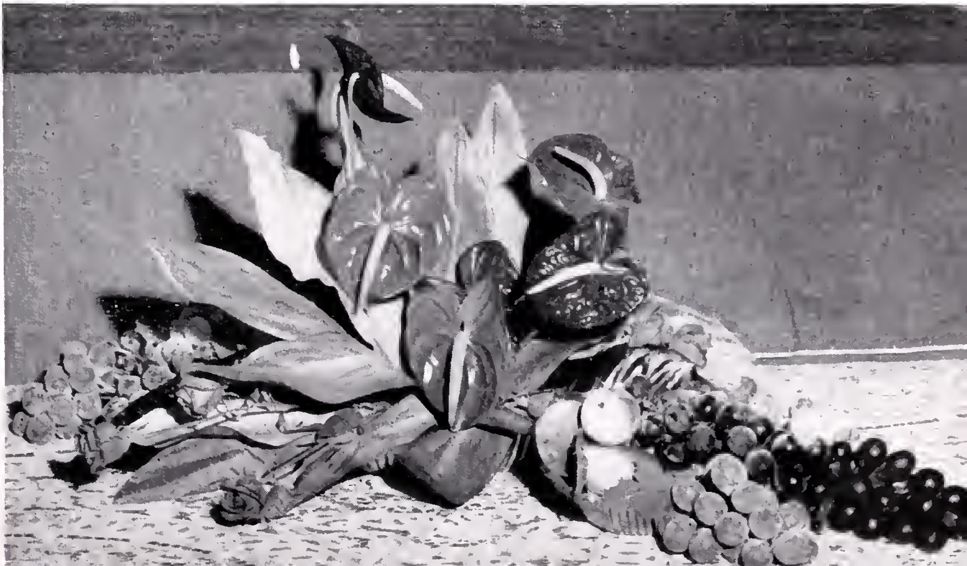


Arranged by Mrs. John Squires *Boutrelle-Sevecke* *Arranged by Mrs. Roy M. Lincoln* *Genereux*

Variations on a theme—two arrangements of fruits and leaves based on Hogarth's line of beauty.

Anthuriums and roses combined with fruit in a colorful arrangement.

Arranged by Mrs. Jesse T. Fort *Maxwell Studio*



Arranged by Mrs. Anne Elizabeth Erhorn

CHRISTMAS DECORATIONS

Instructions for making Christmas wreaths and suggestions for appropriate decorations and flower arrangements for the holiday season

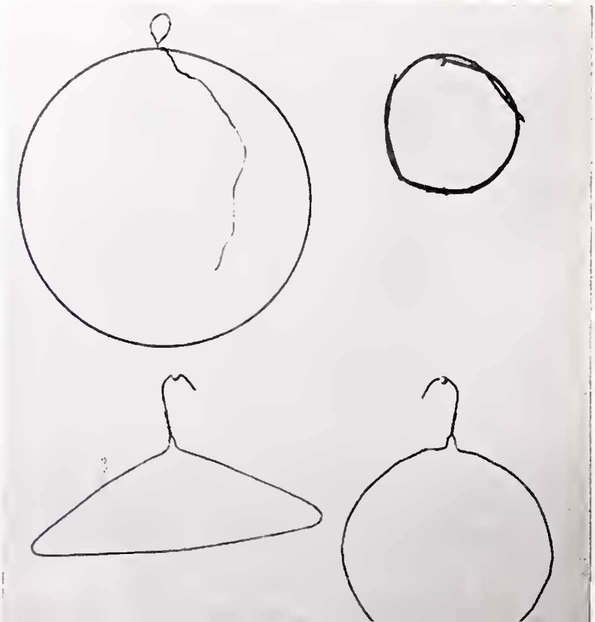
Marion Feddersen

WREATHS have been used for centuries in many lands as among the most beautiful and appropriate of all Christmas decorations. Many kinds of plant material may be used for making wreaths—hemlock, spruce, balsam, broad-leaved evergreens, and even the lemon foliage (*Gaultheria shallon*) sold by most florists. Any of these plant materials may be used alone or in combination for added interest and beauty.

Constructing a Wreath

The bases for making wreaths are rings of heavy gauge wire which can be bought from florists. They come in various sizes —12 inch, 14 inch, 16 inch, etc. If these wire rings are not obtaintable, withes of privet or willow bent into circles may be used. Wire coat hangers bent to shape also make fine bases. If lacquered, they should be scraped with a dull knife to re-

Thompson photos



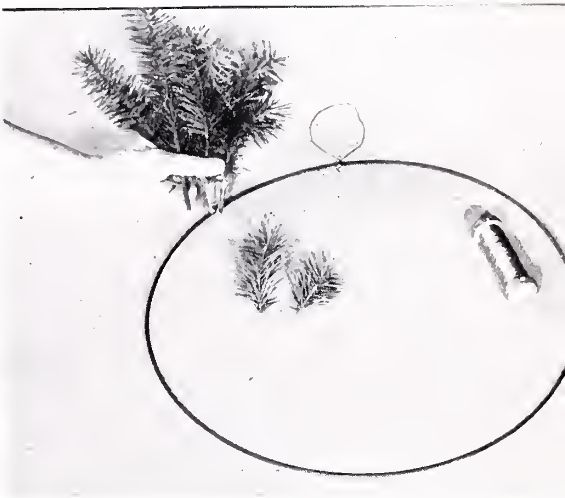
Several types of base can be used for wreaths. Strongest is ring of heavy gauge wire (upper left) purchased from florist. Withes of privet or willow bent into circle (upper right) are satisfactory; coat hanger bent to shape (below) is better.

duce the tendency of the greens to slip. Number 23 wire, used for binding evergreens to the ring, and a good pair of clippers are needed, and a pair of gloves is a decided help.

For decorating wreaths, bows of solid color or two-toned ribbon, pine cones, and dried seed pods are all good. These must be wired individually and secured to the wreath. An interesting way to use medium and large cones is to cut them into cross-sections, using a sharp knife or, preferably, a hack saw. These sections look like flowers. They are wired on the back and fastened to wreaths, or they may be used in flower arrangements.

The pictures on these pages show the steps in making a basic wreath (balsam is used in the one shown) and some variations.

Supply of evergreens is cut in two lengths—5 or 6 inches and about 2 inches. Ring is placed on table and wire (work with wire on spool) is wrapped five or six times around it, pulling firm each time. A 3-inch loop is formed over fingers and wire again wrapped three or four times around ring. Work on table surface, do not hold wreath up in air.



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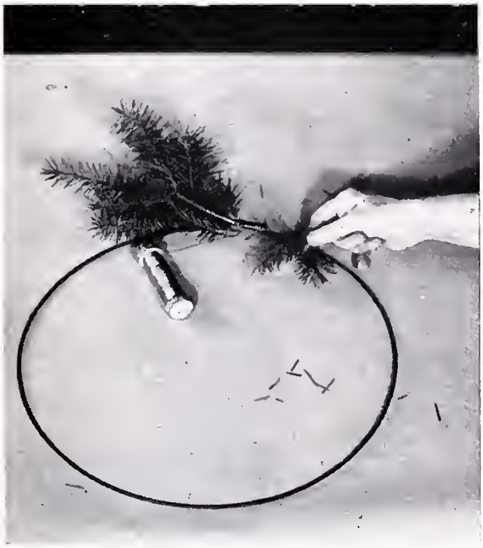


←

Three 6-inch pieces of greens are placed on ring a little to right of loop, slanting outward and covering loop. Wire is thrown over their stems twice and drawn tight. Two 2-inch greens are placed over stems of first cluster, slanting inward, and fastened with two turns of wire. Continue in this fashion around loop, three long greens out, two short ones in. To finish, draw wire over ring three or four times, cut, and insert end under greens.

When adding other materials such as holly or mistletoe, always use basic wreath material in groups of three and two as shown above and add extra material by placing it on top of a group of three long sprays of basic material at whatever points in the wreath desired. ⟶

Balsam wreath decorated with sprays of holly, pine cones, and large red bow.

Della Robbia Wreath

A Della Robbia wreath is decorated with fruits and nuts. These are prepared before making the wreath. The fruits are given a thin coating of clear shellac. When dry a 10-inch piece of wire is thrust through each from side to side near the base. The ends of the wire are pulled down and twisted together. A tiny hole is burned in the end of each nut with a hot darning needle or ice pick. Then the end of a 6-inch piece of wire is dipped in Duco cement and inserted in the nut. When the cement is hard, groups of nuts are tied together like bunches of grapes.

A basic wreath is made and the fruits and nuts are wired to it.

Graduated Wreath

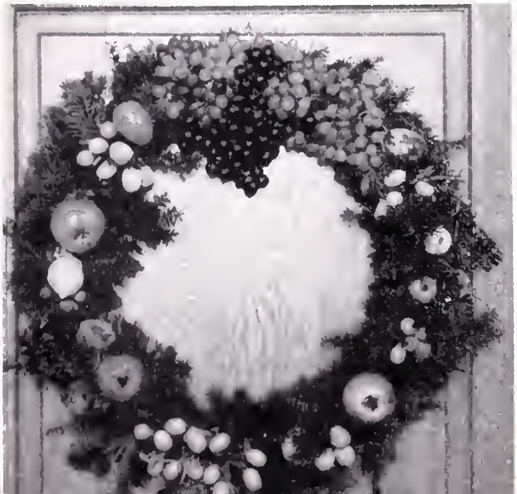
For a new experience, try making a graduated wreath from some lacy green such as arbor vitae (*Thuja*) or *Chamaecyparis.* Prepare the greens in 2-, 3-, 4-, 5-, and 6-inch lengths. Begin wreath as for standard type by fastening wire to ring. Mark the ring with scotch tape at positions corresponding to the numerals of the clock face. Begin fastening 2-inch lengths of greens at 12 o'clock, continuing to 1 o'clock. From 1 o'clock to about 3 o'clock use 3-inch lengths, from 3 o'clock to 4 use 4-inch lengths, and from 4 o'clock to 5, 5-inch lengths. Six-inch greens are used from 5 o'clock to 7. Continue around, using decreasing lengths of greens back to the starting point.

Swags

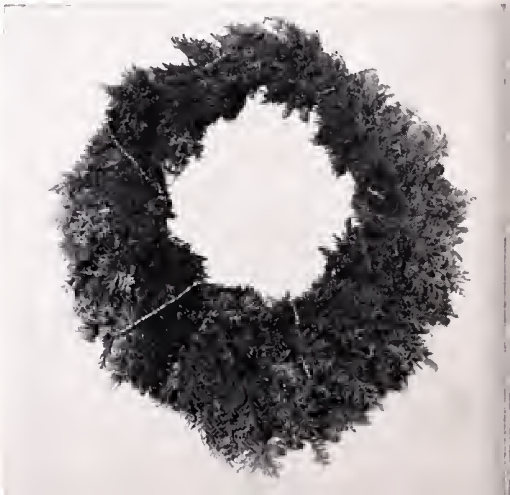
Simple swags of curving branches of two or three kinds of evergreens, with a handsome bow and cones for decoration are easily and quickly made. Two sprays fastened together with wire form the skeleton of the design. On top of these, other shorter sprays are fastened and finally the decoration is added.

Della Robbia wreath.

Buhle



Graduated wreath.



Christmas arrangement of candles, berries, foliage, and fruit in classical style.

Boutrelle-Sevecke photos

Arranged by Mrs. Frederick W. Lewis

Modern Christmas arrangement of candles, palm spathes, and sections of pine cones.

Arranged by Mrs. C. C. Thach

Madonna and Child with driftwood and evergreen branches.

Arranged by Mrs. F. P. Hart

MINIATURE FLOWER ARRANGEMENTS

One delightful phase of the many-sided art of arranging flowers is the creation of miniature bouquets. Just as trees can be classed as normal-sized, dwarf, and bonsai (or dogs as standard, miniature, and toy!), so might flowers arrangements be classed. The arrangement of small orchids shown below could be considered a miniature, while the others correspond to the toy class among animals.

Often when garden flowers are scarce —during hot, dry spells in summer, or after autumn frosts—little blossoms can be found surviving in sheltered spots. From these, lovely small-scale arrangements can be made. The herb garden and the rock garden are frequently sources of delightful material for small scale arrangements. When a large arrangement of choice flowers from the florist has begun to fade, sometimes its enjoyment can be prolonged by using still fresh bits of it for small bouquets.

The same rules of design and color that guide the creation of standard flower arrangements apply to the making of miniature ones. The one important point to remember is that everything—flowers, foliage, containers, and accessories—must be kept in scale.

A group of miniature bouquets. The scale is given by the rose.

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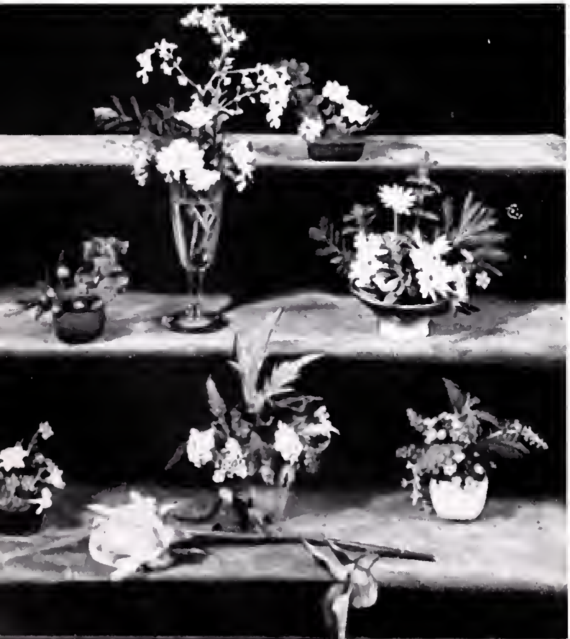
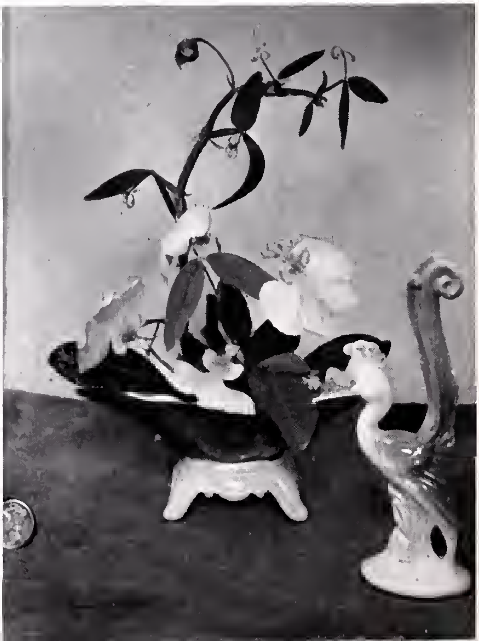


Miniature arrangement of small Oncidium orchids.

Arranged by Mrs. G. E. Smith

Boutrelle-Sevecke



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Mrs. Marion Feddersen shows class in Christmas Decorations how to make sugar-plum tree.

WITHIN THE BROOKLYN BOTANIC GARDEN

CHRISTMAS DECORATIONS CLASS

One of the "busiest" courses in the Botanic Garden's popular education program is scheduled each year the week before Christmas. Classrooms and instruction greenhouses bulge with students and a ton of pine, fir, and other plant materials, as the annual Christmas Decorations classes get under way. Under the capable guidance of Mrs. Marion Feddersen, the guest editor of this issue of PLANTS & GARDENS, and well known exhibitor, instructor, and judge of flower arrangement, students learn the fundamentals of making attractive Christmas decorations for their homes, and carry home what they make.

Most students choose to make wreaths. These range from perfectly plain evergreen ones to elaborate and beautiful Della Robbia wreaths ornamented with fruits and nuts. Among the many other items constructed in this popular class are swags and sprays for doorways and mantles, arrangements with candles, sugar-plum trees, and miniature Christmas trees for tables.

In addition to the Christmas Decorations course, Mrs. Feddersen instructs classes in flower arrangement at the Botanic Garden. These classes are but two of the more than 25 different popular courses offered for adults and children. This unique program covers many phases of plant science and horticulture. Topics range from "how to propagate plants from cuttings," "landscaping the home grounds," or "how to plant and care for house plants" to "flower painting," "Bonsai growing and training," "elementary genetics," and "the plant world through the microscope."

Classes are open to Garden Members and interested laymen of the metropolitan and suburban communities. Information about dates and fees will be sent on request. Write Frances M. Miner, Brooklyn Botanic Garden, Brooklyn 25, New York.

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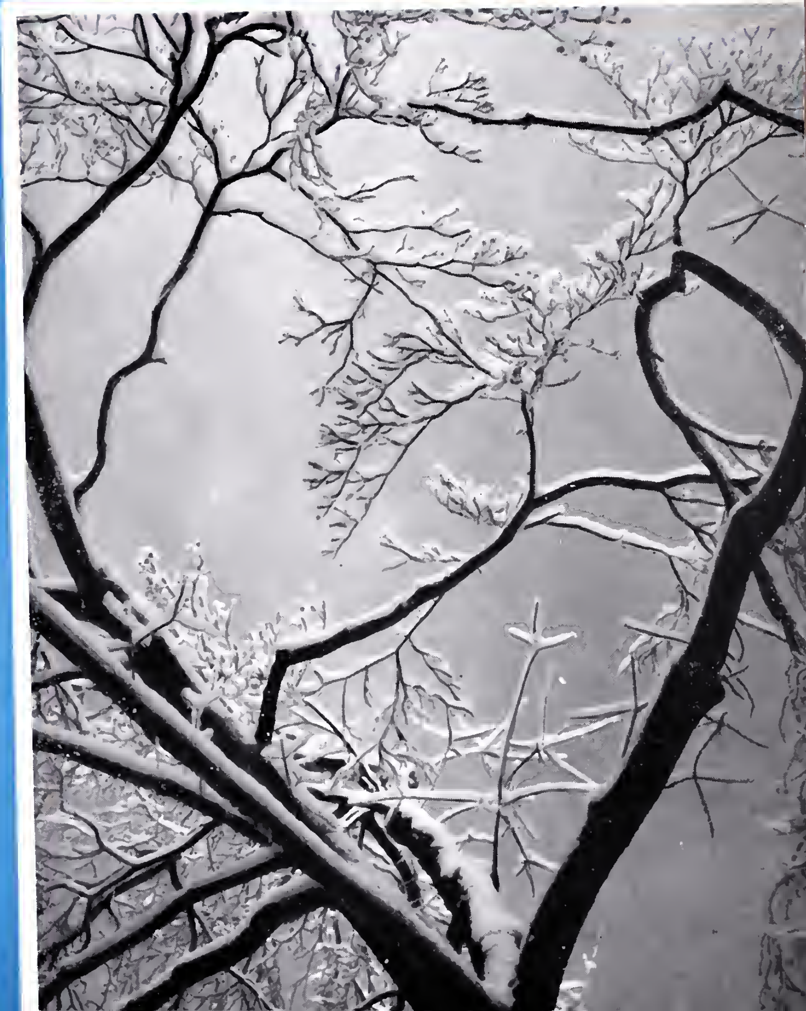

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PLANTS & GARDENS

Vol. 11 Winter, 1955-56 No. 4

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Editorial

Peter K. Nelson, Conrad B. Link

and the Editorial Committee of the Brooklyn Botanic Garden

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Winter 1955-56

No doubt about it, most people are interested in plants. Probably the greatest and in a way the simplest miracle of the living world is a seed. Planted in season it can grow into any one of a myriad of forms—according to its kind. Think of the thrill of discovery that the simple Nomad of some 200 centuries ago must have experienced when he discovered the power of a seed that he could plant at will. His was a discovery that ranks with that of fire and the principle of the wheel. He was the founder of plant culture—"agri", "horti", or whatever its name, but he remains nameless, for this happened before recorded history. He changed the very existence of his thousand generations of grandchildren, of whom we are only one. With agriculture, man could settle in communities and be reasonably assured of something to eat. What has happened since is the story of civilization.

In terms of thousands of years of agriculture, gardening and ornamental horticulture have scarcely made a start. Compared to the thousands of people who know how and what to grow to amplify the beauty of their homes, there are millions who have yet to discover ornamental plants, much less, know their names. Believe it or not, the overwhelming majority of people know but three "kinds" of decorative plants—shrubs, trees, and "flowers". Now if ever the time is ripe for an educational crusade to bring beauty along with knowledge into the lives of more people. With it will come a measure of the mental peace and happy satisfaction that gardeners and amateur horticulturists know so well.

This is the eleventh year our Editorial Committee has had the warm cooperation of authors and publishers in bringing PLANTS AND GARDENS' readers a broad view of the year's developments in the world of plants. The articles that follow were carefully selected for their interest and/or significance, and cover a wider range than have the selections of some years past.

Sincerely yours,

George S. Avery, Jr.

Director

Owen

In a city greenhouse, filled with the potted seedlings they started last fall, Camp Fire Girls take a plant apiece to place around the town.

PRECOCIOUS PLANTERS

Camp Fire Girls replace Wichita's dying trees

Reprinted from *Life,* May 2, 1955. Courtesy *Life* Magazine

In Wichita, Kansas, where drought and disease have killed thousands of elm trees in recent years, an out-sized problem was getting lively attention from some pint-sized citizens. Last fall the Camp Fire Girls of Wichita collected thousands of seeds from the city's few golden-rain trees, a particularly hardy species, and planted them in a municipal greenhouse. This spring on Arbor Day, the seeds having sprouted into seedlings, the girls were back in the greenhouse, ready to renew their ambitious program to replace Wichita's dying trees.

Taking the 600 seedlings which had flourished and another 300 year-old saplings they had bought from a nursery, more than 1,500 girls marched out of the greenhouse and dispersed about the city to plant the trees in hundreds of backyards. In the months ahead they will watch the tiny trees and nurse them along. Meanwhile, bombarding the city with posters and pamphlets, they are urging the grownups to plant trees too. And for the next 10 years they intend to get equally hardy species started every spring, so that in 1965, when today's Camp Fire Girls will have sprouted into young ladies, Wichita will have sprouted some 50,000 new trees.

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Mamay

The busiest day of the year—planting day at the Children's Garden of the Brooklyn Botanic Garden. This is one of the pioneer children's gardens in the United States.

HORTICULTURISTS OF TOMORROW START TODAY

Florida schools hew to that slogan with basic lessons on plants

C. A. Harris

Condensed from *The New York Times*, April 3, 1955

Elementary gardening is among the most popular subjects in many schools in Tampa, Florida. Classtime for junior gardening activities is allotted on a regular basis. The over-all project is sponsored by the Tampa Federation of Garden Club Circles, and lessons are taught by members of adult clubs assisted by classroom teachers.

Various basic lessons are included in the project. For example, I spent an entire day watching fourth and fifth grade children skillfully air layering large branches of their favorite shrubs. Without adult assistance the youngsters assembled materials and proceeded to prepare professional-looking air layers with small, deft hands.

But this was a planned success, indicative of the care with which these lessons

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are taught. For weeks before my visit the class had started working on branches of ligustrum, camellia, croton, and other shrubs until every member was thoroughly familiar with the process. Then each child was given sufficient materials to air layer a plant of his or her own choice, either in the garden at home or in one of the designated areas on the school grounds.

The garden club member who serves each class spends three days a week teaching the simple steps of some phase of horticulture. The program then is continued in her own garden where the youngsters are welcome to come and "talk shop" after school or on weekends or even on some holidays.

Harris

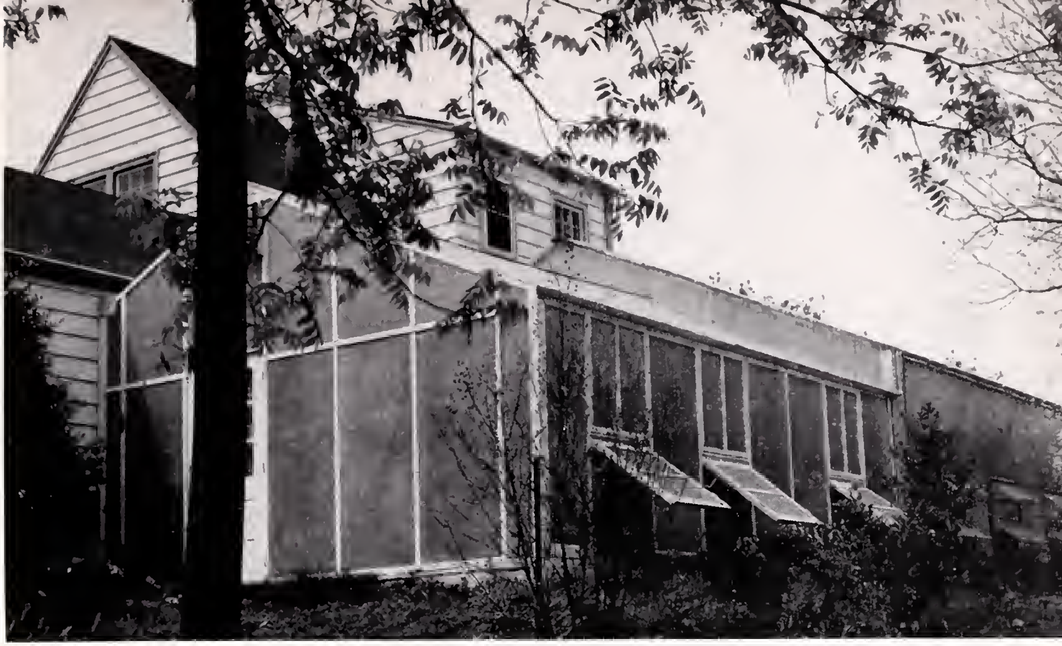
Tampa school children air layering a hibiscus plant.

304 BUSHELS PER ACRE!

Youth has made headlines in many areas of gardening and agriculture in 1955. This year saw the attainment of a goal that many considered an impossibility a few years ago—growing 300 bushels of corn per acre. And the goal was achieved by a sixteen-year-old, Lamar Ratcliffe of Baldwin, Mississippi. At the time soil scientist George D. Searseth suggested in an article in *Farm Journal* magazine 9 years ago that such a yield should be possible, the record was 190 bushels per acre. Many scoffed, but *Farm Journal's* Wheeler MacMillen and others believed in the idea, and found a few farmers who did, too. In 1947 five farmers tried for the mark. All fell far short. Corn scientists and farmers got together to figure out ways of improving yields. In 1948 more than 250 farmers made the try—the record was 224 bushels. Records from that time on regularly hit above 200 bushels, and now the 300-bushel dream has become a reality.

The field on which the record-breaking crop was grown is small—only about 1½ acres in a little hollow among steep hills. It is startingly like the locality recommended in the original *Farm Journal* article as being the most likely to produce the 300-bushel crop. In addition to the favorable site, there were other contributing factors. Of prime importance was the very heavy fertilization. Last fall the stalks of that year's crop were disked into the soil and 25 wagonloads (nearly 15 tons) of manure were put on. The soil was ploughed eight times during the winter. Before planting, 1000 pounds of 14-14-14 fertilizer and 200 pounds of nitrate of soda were applied. When the corn was about 18 inches high, it was side-dressed with 300 pounds of ammonium nitrate.

Other important factors were water and seed. Luck was with the young farmer—rainfall this year was abundant and came at the right time. The seed used was Funk's G-711 Hybrid.



Author Photo

Fiber glass greenhouses built by the owner with aid of only one other man.

New as Tomorrow . . .

FIBER GLASS GREENHOUSE

. . . ideal for orchids and other plants, too

Eleanor B. McClure

Condensed from *Popular Gardening*, January, 1955

THE two greenhouses F. O. Reh has built on the grounds of his home near Belleville, Illinois, are so modern that many people find them as exciting as his fabulous collection of orchids and other exotic plants. They're built of fiber glass—a plastic made by pouring a syrupy resin onto a blanket of glass fibers.

Fiber glass is featherweight yet so tough that a grown man can jump on a panel without damaging it. Neither sun, frost, nor snow can crack or warp it and it is hail-proof. Moreover, it is a versatile building material. It can be cut, sawed, bolted, and nailed. Two sheets can even be glued permanently together with a gooey layer of mastic.

Today, panels tinted a pale amber "daylight" tone are sold under the trade name Maxlite. But at the time Reh wanted the plastic he couldn't find either plain or corrugated panels in the desired color which allows 85 per cent natural sunlight to enter the house while screening out from 30 to 40 per cent of the infrared rays. He had some made to order and since available frames, designed for conventional glass panes, were not suitable for the plastic panels, he also had the framework for his house tailor-made. Unhampered by traditional dos and don'ts of greenhouse construction, he dreamed up a radically different building, one that would make the most of the special advantages offered by fiber glass.

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F. O. Reh fixing panel of fiber glass in place.

Since plastic panels besides being strong come in large sizes—as large as 12 feet long and 44 inches wide—the number of structural parts of a building can be reduced to the minimum. Even the usual foundations and footings can be eliminated because fiber glass will not rot and can, therefore, be placed right into the ground. Among other advantages, this substantially increases the glazed area, the well-lit usable space in the house.

Construction

The framework for Reh's first fiber glass house proved to be much heavier than was necessary. Numerous supports, therefore, were eliminated in the second. Instead, for example, plastic sheets were overlapped and fastened with mastic wherever possible. Fiber glass panels for the roof were laid on neoprene pads molded to fit the corrugations in the plastic. An electric drill was used to make holes in the panels on both sides of each steel support. The holes were spaced in pairs so that long, aluminum "straws," fitted with neoprene washers, could be drawn through from the outside and twisted together around the steel supports to fix the plastic sheets tightly in place.

Heating and Ventilating

Even more unusual than the construction of these houses are the ingenious mechanical devices used to heat, ventilate, and humidify them. Warm air circulating units with adjustable baffles are suspended from the ridge of the roof of each house. These efficient units use steam piped from an oil-burning boiler in an adjoining utility room. Two-speed propeller-type fans circulate heat so effectively as to maintain an even temperature at all times.

These heaters and their fans, controlled by thermostats and aquastats, can be operated independently. In winter, a heater takes the cold air from under the roof and warms and circulates it before there is any condensation. It doesn't run continuously but shuts off when the sun comes out. Even an overcast sky gives enough radiation to cut off the heater during daylight hours. In summer, the heater fans do yeoman duty for they operate almost continuously as cooling fans, forcing away air that has been heated by radiation under the fiber glass roof.

Moist Atmosphere

The atmosphere in each house is kept pleasantly moist by a humidity machine fitted with both a humidistat and thermostat. If the humidity drops as much as 2 per cent, the water-jet and fan spew out a misty cloud of vapor and then the machine turns off again. It also operates independently as a cooling fan. Although high humidity is maintained in the houses, the atmosphere is far from steamy. Indeed, the air is fresh and invigorating.

Light

The exceptional quality of the light is what impresses people most. Bright and nearly like natural daylight in intensity, it is so thoroughly diffused that nothing casts a shadow.

Orchids Do Better

It surely seems that the orchids, since they were moved into the first plastic house in July, 1952, have fared better. They are growing more rapidly and sturdily than they did in the old glass house. There was a marked contrast in two groups of small orchid plants from the same batch of seedlings. Soon after the first plastic house was completed, one lot was moved into it. Compared to that happy little colony, the incubator babies in the glass house looked sick.

Orchids in the plastic house have leaves of a richer green and flowers of firmer substance and richer colors.

Other Plants Too

All sorts of plants besides orchids flourish in the plastic house. Ivy and fittonia seem to enjoy the intense light. African violets submit to overhead watering and bloom continuously. Bromeliads and veltheimias also seem quite content and jade plant (*Crassula*) has made symmetrical growth on the ground beneath the bench.

All plants need much more water when grown under fiber glass. They also need a greater volume of air than plants in the conventional glass house and almost constant air circulation.

"When the ratio between air and light intensity in a fiber glass house is right, you can grow plants close to the plastic. Their leaves can even touch the plastic without burning either in summer or in winter," Reh says. "Each of our houses drops from about 12 feet at the highest point to a low of 7½ feet at the eaves."

Kit Available

A ready-to-erect fiber glass greenhouse kit will be made available soon for both amateur and commercial growers. The metal framework, tailored to fit the plastic panels, can be put together easily enough by any man handy with a wrench and screwdriver. Heater, fans, and humidity machine are included.

Although plastic glazing material costs more than glass, the cost of both type greenhouses comes to about the same in the end as the fiber glass house is so easily and economically put together. Furthermore, maintenance costs are saved with the fiber glass house. It doesn't need painting, caulking, reglazing, or shading. But provision must be made for proper air circulation. A simpler system than Reh has is now being worked out.

House, more than 12 feet at highest point, provides good air circulation.

Author photos

Vinyl film on light bamboo frame keeps out cold but admits light; row crops get off to a flying start.

The Japanese have a word for it . . .
"Vee-neel," and with it they make

GREENHOUSES BY THE MILE

James R. Turnbull

Reprinted from *Monsanto Magazine,* October-November, 1955

TRAVELERS by fast electric train between Tokyo and Osaka, Japan's principal cities, have by now become accustomed to a springtime phenomenon, the appearance of the "vee-neel". Like enormous translucent caterpillars, these covers for tender crops stretch in rows over the undulating slopes and terraced hillsides. The "vee-neel" is Japanese for vinyl plastic film, used, as in the United States, for raincoats, umbrella covers, and a hundred other useful articles.

But it took the Japanese, with their tremendous need for maximum yield from a limited amount of arable land, to discover that vinyl film can be the farmers best friend.

As manufactured, vinyl film is sold in 100- or 200-yard rolls 60 to 90 inches wide. With the aid of springy staves of the ubiquitous bamboo, a farmer can quickly convert a roll into a semicircular hood over a 100- or 200-yard crop row.

Springtime — January, February, March, and April—in Japan's main island of Honshu, is usually sunny and bright. But the days are cool and the nights can be frosty. The sun's warmth, trapped and concentrated under the vinyl covers gets many row crops off to a flying start. Green vegetables, flowers, tobacco, and berries are among the many high-value crops in which the use of vinyl film covers is expanding rapidly.

Two Crops Per Year

More dramatic, in terms of Japan's chronic shortage of cereal grains, is the use of vinyl film covers to get two grain crops per year in areas where previously

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only one crop was feasible.

In central and northern Honshu, (and even in Japan's "Alaska," the northern island of Hokkaido) this is accomplished by planting the acreage in hardy winter wheat or barley. As the crop develops, during the chilly spring weather, rice seedlings are started in adjacent beds under vinyl covers.

The protective vinyl, with its good insulation value and high light transmission, enables the tender young rice plants to mature rapidly and safely. The wheat or barley is harvested in early June, just in advance of the rainy season. The rice seedlings are set out at once in the fields thus made available. Thanks to their head start under vinyl, the rice plants mature well before the danger period of fall frost arrives.

Other Uses

As the "mileage" of vinyl film in the hands of Japanese farmers increases each year (more than 15,000,000 yards were sold for this purpose in 1954-55 winter season), these ingenious toilers of the soil have quickly found additional uses for the plastic sheeting. Taped or sealed together at the edges, vinyl film makes a "tent" to shield orange trees from frost in the border-line zone for this valuable crop. The same tents are also used when the trees are fumigated, increasing the effectiveness of the insecticide used and reducing the amount necessary to do the job.

Larger vinyl covers are used for crop fumigation. The harvested product is mounded or stacked in the field, covered with vinyl film "tarpaulin" and methyl bromide or other suitable fumigant gas introduced under the cover. Again the high gas retention of the vinyl permits thorough fumigation with minimum use of expensive toxic agents.

Greenhouses

In addition to improving yields of field crops, vinyl film offers an inexpensive means of constructing semipermanent greenhouses. They are widely used in Japan both by small-acreage farmers and by home garden hobbyists. A light framework of 1 x 2 lumber with rafters on 12- or 14-inch centers is most frequently seen. Such greenhouses have withstood high winds and hail, but are not recommended where a heavy snow load can be anticipated.

In the United States, flexible plastic films of either vinyl or polyethylene plastic are now available in widths up to 120 inches. Thin wood laths would probably have to replace the Japanese farmers' bamboo staves. But for a relatively modest investment, high-value crops can be started in the intermediate and northern zones of the country from 30 to 60 days earlier than at present.

As for the home gardener—who hasn't raced his neighbors to see who could serve the first ears of "eatin' corn" on the block?

Author photos

Light frameworks of wood covered with vinyl film make inexpensive, semipermanent greenhouses.

Cabinet complete with fluorescent lights and sliding glass doors provides easy and efficient way to grow house plants successfully.

GROW PLANTS UNDER FLUORESCENT LIGHTS

How to succeed with house plants even without adequate window space

Peggie Schulz

Condensed from *Horticulture*, March, 1955
With additional illustrations

Success with house plants is largely dependent on proper window placement. And what enthusiast ever has enough sunny windows? Nowadays you need not let this lack of sunlight curtail indoor gardening. Electricity has come to the rescue and can make every day a "sunny" day. Fluorescent lights suspended at proper distances above plants will make them grow beautifully in basements, on windowless walls, or in dark corners. Indeed, in many instances, light-grown plants are superior to those grown in bright windows.

Published at Horticultural Hall, by the Massachusetts Horticultural Society, Boston 15, Mass.

Town Journal

Plants flourish on utility cabinet with concealed fluorescent lights.

Cabinet built to fit available space becomes integral part of room.

Basic Materials

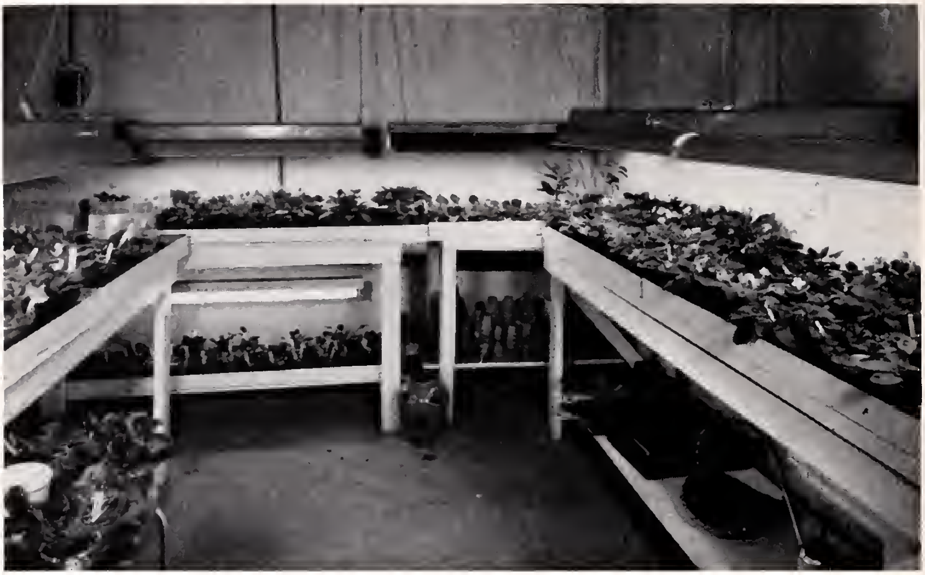
For a simple setup you need two 48-inch 40-watt daylight or white tubes and starters. Some type of reflector, either purchased or homemade, is also needed to concentrate the light on the plants. The tubes minus a reflector cost approximately $13; with reflector, $20. You can make a reflector from a piece of plywood. Paint it white and mount the tubes on it.

Lights may be suspended by a chain or pulley over the plants, or they may be mounted in a cabinet, with the plants under them. If designing a stationary unit, place the lights so there will be about 18 inches between the tubes and the bottom of the pots. This allows room for an occasional gift plant or the rejuvenation of an ivy or philodendron. Many basement gardeners fasten pulleys to the plant shelves or to the lights and reflectors in order to raise and lower them according to the plants' needs.

Tubes last 12 to 16 months and replacements cost a dollar per tube. However, after 6 months the light intensity of a tube decreases considerably. The cost of running fluorescents is approximately one-fourth cent per hour for two 40-watters. The best results as to flowering come when the lights are left on 12 to 16 hours daily.

African Violets

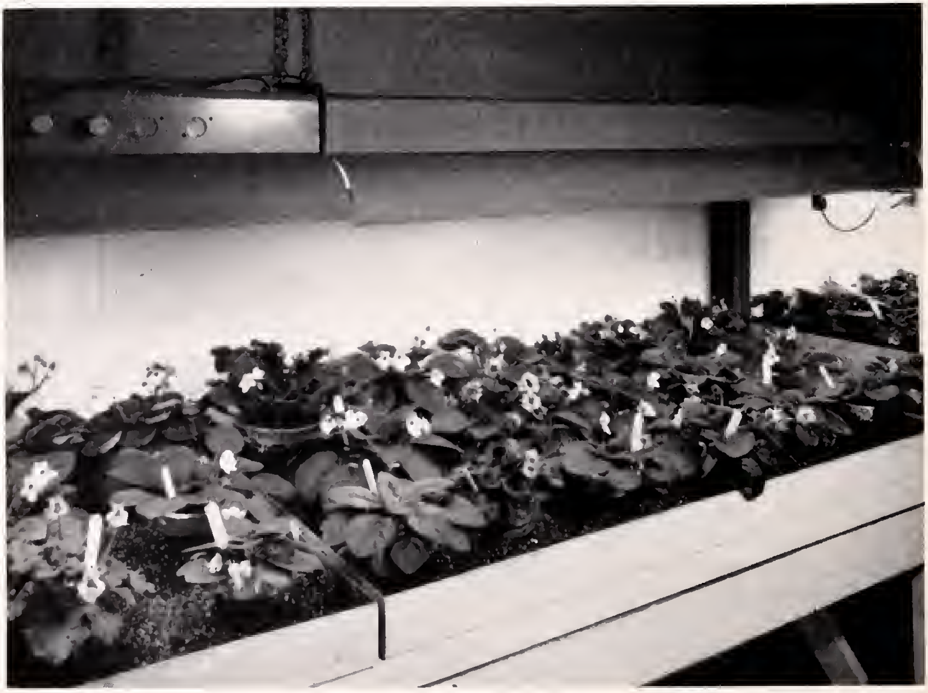
African violets are most popular for "under-the-light" culture. Tests conducted at various universities and experiment stations show that they need from 300 to 600 foot-candles of light, depending on size and stage of growth, for good growth



Basement "greenhouse" constructed by Mr. and Mrs. Myron Hoffman of Rosyln Heights, Long Island.

Mrs. Hoffman's prize African violets thrive under fluorescent light.

Gottsho-Schleisner photos



and flowering. Small plants in 1- to 2-inch pots can be placed 2 to 4 inches from the lights; plants in 3- to 4-inch pots about 11 inches away. Always measure from the tube to the pot rim. For accuracy, use a photo meter.

However, this simple guide should give a clue as to the amount of light African violets are receiving. If foliage turns yellow, they are receiving too much light. If leaves are deepest green, stems are long and weak and bloom scarce, they are not getting enough light. The remedy for this is to bring them closer to the lights. Most gardeners use inverted flower pots for this purpose.

Other Gesneriads

Gloxinias and most other gesneriads (with the exception of episcias) need more light than African violets. Place the small ones 2 to 4 inches from the lights; plants in 5- to 6-inch pots about 8 inches from the tubes. When their buds expand move them from the lights to a window and give the space to needy plants.

Most foliage vines can be grown in relatively low light intensities. Since the area in the center of the tubes sheds strongest light, place light-loving things there and the greenery toward the end zones. Setting pots atop moist sand or pebble-filled trays heightens humidity. Take care, though, to keep the water in the pebbles below pot level.

Ventilation

Ventilation is really all-important. "Upstairs" plants usually receive enough fresh air from the opening and closing of household doors. If you grow plants in cases, open the doors for a while each day to admit fresh air. Day temperatures of 70 to 75° F. and night readings at 60 to 65° F. are considered best for most house plants.

Watering and Feeding

Water and feed plants under lights exactly as you would window-grown plants. Use room-temperature water and moisten the soil thoroughly. Then let the topsoil dry out before giving another soaking. Water on furry-leaved plants needn't bother you, since the "artificial sun" will not burn the leaves.

Use an all-purpose fertilizer (I like the soluble kind) and fertilize growing plants twice a month. Small seedlings should receive only one-fourth the usual dosages.

* * *

FURTHER USES FOR SPECIAL LIGHTING

—From Mrs. Schulz's recent book (see page 295)

Rooting cuttings. A specially built wooden box with lights in the cover, or a terrarium with a light over it, is ideal for rooting cuttings of many kinds. Good, also, are plastic refrigerator boxes or ordinary clay pots with plastic bags tied over them and set under a light. Various rooting media may be used.

Bonsai. These highly prized dwarfed trees are often difficult to keep in good condition in modern over-heated, unhumidified homes and apartments. A case or terrarium equipped with fluorescent lights not only provides needed light and humidity, but provides a dramatic setting for their display as well.

Fresh herbs and salad greens add zest to winter meals. Among those which thrive under artificial light are parsley, chives, mint, marjoram, basil, cress, and even lettuce.

GARDEN LIGHTING

For beauty, safety, work, and play

John R. Rebhan

Condensed from *Flower Grower*, April, 1955

You don't know your garden until you've seen it lighted at night. It develops a new personality, completely different from its daytime look. Lighting gives more hours for outdoor living.

Installation

The development that brings garden lighting within the reach of everyone is the waterproof extension cord with its moisture-proof connections. From an electrical outlet, these cords may be laid over the ground, hidden among shrubs and flowers where they will not be walked upon. To them one may attach several lighting fixtures. Fixtures are weatherproof and wired ready to be plugged in. It is not necessary to lay numerous expensive cables to achieve results. Garden lighting has become as simple as lighting a living room.

General Electric

Terrace lamp for reading and general illumination shows good design available in outdoor fixtures. Lamp by Lightolier sells for about $40; is fully weatherproof.

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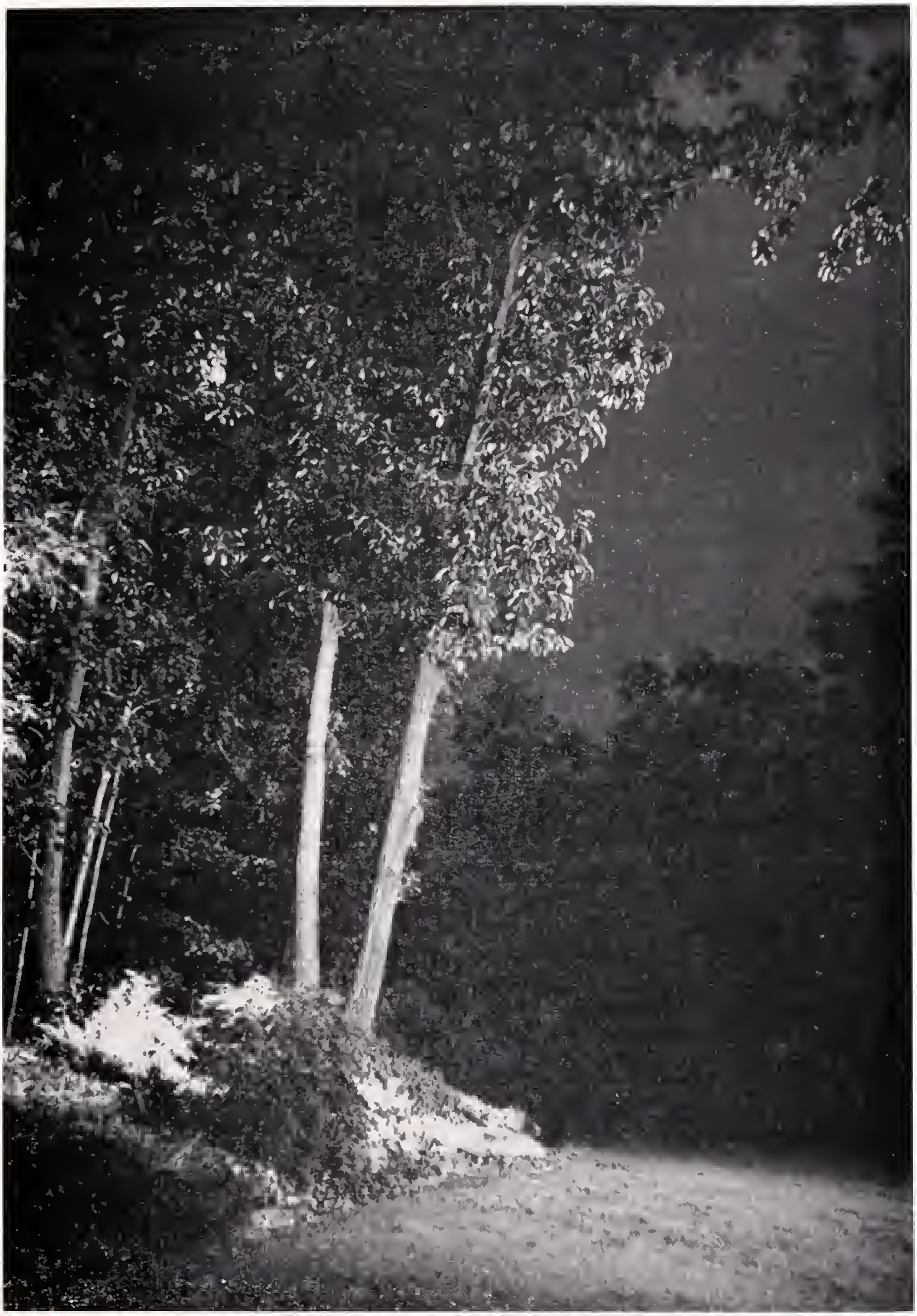


Gottsho-Schleisner

Lighting brings out colors in flowers and emphasizes textures and patterns in foliage. Use flood and spot lights combined for soft general illumination; spot lights to pick up interesting detail.

Single lamp game light has adjustable lamp and can be moved to any location and spiked into ground. Has extendable pole, weatherproof cord; sells for about $8.

With these cords you do not need a weatherproof outdoor outlet. Open a window an inch or two and place a piece of board in the opening. Drill a hole in the board and run weatherproof extension cord through it to an indoor plug. This is a temporary set-up and may be used for parties and occasional garden illumination.

For a permanent installation, at least one waterproof outdoor outlet is necessary. You may be able to plug in the outlet on an existing circuit in the garage or house. Be careful not to overload the circuit.

For such an installation, neoprene direct burial cables are run underground to an outlet box which may be attached to a tree or building, or left free-standing. Experiment with a temporary installation as mentioned previously to find the most advantageous locations for permanent outlets.

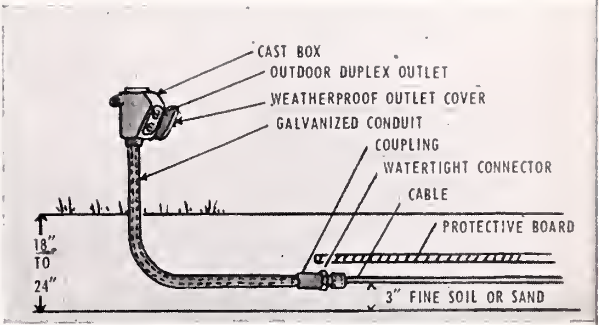
Local regulations vary, and cable laying and wiring may have to meet the specifications of an electrical code. Generally it is best to have an electrician attend to all wiring jobs for permanent installation. The electrical service company may give free advice or assistance. Many homeowners dig their own cable trenches and after the electrician has installed the cable and had it inspected by underwriters, fill it in, thus saving considerable expense.

Whether you have a permanent installation or a temporary one, plug in fixtures or replace bulbs in a dry garden. After each lamp has been plugged in, turn on the electricity. If you place a light in a pool, do it before turning on the current.

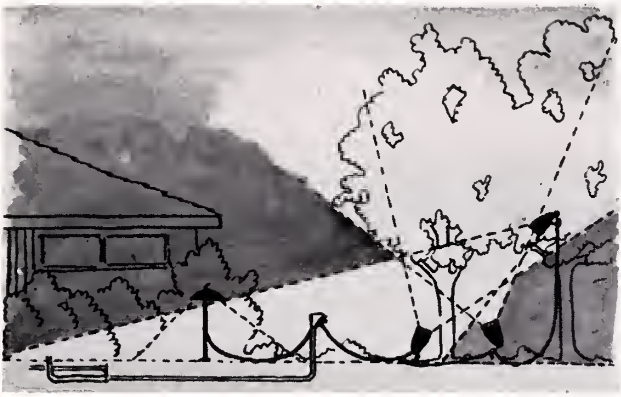
Lighting Fixtures

Lighting fixtures are rugged and weatherproof, designed for year-round use. Terrace and path lights require only ordinary bulbs, while those for work and play areas and for garden picture effects or general illumination require 150-watt or larger PAR spot or flood lamps. Most fixtures are portable with stands or spikes that are merely stuck in the ground where wanted. Spotlights may be attached to trees and buildings, and the fixtures may be turned at any angle. Simple floodlights, completely wired and ready to be plugged in, sell for as little as $3.00. Few elaborate fixtures cost more than $15.00; the majority are in the middle price range.

Outdoor illumination requires little current. One 150-watt flood PAR bulb will illuminate about 1200 square feet of trees 40 feet away if used in one of the sleek bullet-type reflectors. One 150-watt lamp will illuminate a game or parking area about 40 by 40 feet. An ordinary 60-watt bulb in a mushroom or ornamental fixture beside a path will light up an area 20 feet in diameter. While these are safety lights, they also throw interesting lights on the lawn and shrubs.



Weatherproof outlet is economical to install. Direct burial cable placed in a trench gives a permanent source of electricity. See below for a way to use outlet.



Extension cords from outlet shown above link several fixtures to one permanent source of electricity. Fixtures may be moved or brought indoors as desired.

Linda Murphy drawings

General Electric

Mushroom fixture is spiked into ground and directs light on steps. Retails at about $8.

Lighting for Beauty

In lighting for beauty it is best to concentrate on one or two points of interest. You may pick up an interesting group of trees or shrubs or pinpoint a light on geraniums growing some distance away. Experiment: the effects are unlimited. To avoid flat effects that destroy a feeling of depth and form, light flowers and other objects from the side rather than from directly in front. Flowers are best illuminated with white light, but for water features and garden structures, yellow, blue, red, and green bulbs or lenses are available.

The farther the objects to be lighted

are from the light source, the fainter the illumination will get. Solid objects, such as trees in full leaf or structures, will be illuminated more effectively than bare trees. Take advantage of light reflected from light-colored buildings, fences, or other structures; decorative lighting may throw reflected light on a parking area.

Insects

With all these lights won't the insects they attract prevent even stepping outdoors at night? Remember that yellow lights discourage night-flying insects and come in 60-, 100- and 150-watt sizes.

Effect on Plants

A question certain to come to mind has to do with the effect of lighting on plant growth. Southern readers will naturally avoid lighting poinsettias until the bracts show color; Northern readers will not light chrysanthemums indiscriminantly. Little research has been done on this phase of garden lighting, but reports from readers who are already enjoying their gardens at night mention no ill effects.

Here is a bonus feature of lighting: with the flip of a switch, you can light the garden and scare prowlers into outer darkness!

Gottsho-Schleisner

Garden lighting gives greater enjoyment from picture window. Scenes viewed from lighted room require brighter light than those seen from unlighted room or dimly lit terrace.

SEED GERMINATION

Why good seed in good soil may not germinate, and what to do about it

R. Milton Carleton

Condensed from *National Horticultural Magazine*, April, 1955

With added illustrations.

All too often, gardeners feel that all they have to do is to stick seed into the soil and it will grow. If it doesn't, it must be dead. They ignore the fact that the original home of the species might have been tropical Africa or northern Europe, South America or the slopes of the high Himalayas, with needs peculiar to that region.

True, some seeds have wide tolerance for heat and cold, moisture and drought, and survive almost any treatment. Perhaps the most tolerant of seeds in commerce are those of vegetables. Man cannot afford to rely on miffy, erratic species for his food. He must have food plants that are almost certain to grow when planted even under adversity. Because vegetable seeds survive abuse, seedsmen expect no more than about one complaint for each ten thousand packets sold. They are amazed if they can hold complaints on flower seeds to one for each two thousand packets. Actually, the reliable seed house maintains about the same standards of germination for both flower and vegetable seeds. I doubt that there are many seeds offered today testing less than 80% to 90%.

Why then does the amateur fail so frequently with flower seeds when his luck with vegetable seeds is above the average of success with living materials in other fields?

The answer is that flower seeds comprise a much more complex, heterogeneous mass of material. With but few exceptions, vegetables originated between 30° and 50° north latitude in Europe, a relatively narrow climatic zone. Hard-to-grow species fell out of use when they failed to produce a crop every growing year.

In the case of flower seeds, common, easy-to-grow species are still in demand. Zinnias and marigolds together outsell all the rest of the flowers in commerce. They do so because failure with these is all but impossible.

As the gardener gains experience, however, he demands more difficult species. He no longer wants small-flowered petunias, for instance; he demands the big doubles or giant fringed types that challenge the skill of the expert to grow well. He insists on trying to grow lupines in the Middle West, or even *Meconopsis baileyi* from the high Himalayas.

The unfortunate factor in this demand is the lack of knowledge behind seed growing. Failure is as disappointing to the seller as it is to the gardener. With no control over the actual growing operation, he is held responsible for the results of a delicate highly perishable product. I don't want you to think the following letter epitomizes the average customer, but it does show the type of reasoning sometimes applied. This concerns a packet of double petunias of the current crop, germination given by the grower as 96% and actually testing 98% in our test room. Here's the letter:

"The petunia seed you sent me was no good. It didn't grow. I am seventy-six years old and have a low blood count. Can you help me?"

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1600 Bladensburg Road, N.E., Washington, D. C.

Ever-popular zinnias are easy to grow. Seed failure with these is almost unheard of.

As silly as that letter is, it is no sillier than many I read. You'd be amazed how few people realize there is any difference in the germination of various species. We get thousands of letters asking for help on failures with flower seeds, with no clue to how they were planted. They were planted, Period. They ought to grow.

Pansies will not germinate well if the temperature is too even; they require fluctuating temperatures.

Roche photos

Temperature Effects

This type of report has made me a good detective. By piecing together evidence, I can often come up with a guess as to what happened. For example, a woman wrote to complain that pansy seed she bought in January was no good. Planted in January, not a seed had sprouted by March. No information whatever on how it was planted.

Weather reports showed her area had dull, cloudy weather all spring. The letter was written on good paper from an impressive address. My guess was that she sowed the seed in a flat in a window and left it there. The house probably had thermostatically controlled heat, held within 3 or 4 degrees of 70°F. No sun, hence even sunny windows never went above that temperature.

Seed of double petunias cannot be stored over winter at room temperatures but must be kept at low temperatures.

My analysis of the situation was correct. This told me exactly what was wrong. Pansies belong to the group of plants that need rather wide fluctuations in temperature to sprout—50° F. at night and 90° during the day. At steady 70° they just sulk. That is why we plant pansies in fall—natural temperature variation between night and day forces germination. Pansies *will* germinate with smaller variations, but steady temperatures stop them cold.

Inside the seed, mechanisms of checks and balances set up by nature permit survival during periods of adversity. These periods may be seasons of cold or drought or lack of sunshine. This is what we would expect from a heterogeneous body of plant material that originated from as diverse regions as the tropics, the temperate zone, and in the sub-artic. Each special mechanism served some purpose in its native habitat. Again, let's use the pansy as an example. Because fresh seed falling to the ground in midsummer might flower, go to seed and die, the plant needed some mechanism to delay flowering until the following spring. For this reason, seed does not germinate until the cool days of late fall create the all-essential temperature variations.

If we insist on going contrary to nature in sowing seeds, we must compensate for this by artificial controls of temperature. For example, lettuce seed needs temperatures above 42° but below 55° for good germination. If lettuce seed is sown in the Middle West in midsummer, most varieties fail to sprout. We can circumvent nature here by mixing our seed with damp sand and peat moss, and storing it in the refreshener pan of the refrigerator. When it sprouts, the sand, peat, and seed can all be sown at once. Annual larkspur and perennial delphinium also do best at the same temperature range, and can be germinated by the same methods.

When we talk about optimum temperature, that doesn't mean some seedlings won't appear if the soil is too warm or too cold. There is tolerance in seeds, so that 10 degrees one way or another may produce some seedlings. But the farther you get away from optimum temperatures, the poorer the results.

We used to sow delphinium seed under shade in late August. By keeping off the sun, we could reduce soil temperatures sufficiently to get good germination. When we tried to grow in spring, temperatures were better, but we got no germination. Delphinium seed lost germination so rapidly as to be worthless.

Work by Dr. Barton at Boyce Thompson Institute of Plant Research, however, showed that delphinium seed kept under cold temperatures was just as good as fresh the next spring. Since then, we have built elaborate storage facilities for keeping a number of species of seeds over winter which will not retain viability at room temperature. Fine double petunias are among these. A good many of the failures with these can be traced to gardeners who order early, then keep the seeds on open shelves in a warm room.

Alternating Dormancy

The problem of alternating dormancy is not so easy to solve.

Alternating dormancy means that fresh seed may sprout vigorously, but 2 or 3 months later seem dead. Wait 6 months and retest, and germination is way up. Six months later, down it goes again.

In the case of any perennial seed that doesn't sprout, yet stays firm and does not rot, suspect alternating dormancy. Don't discard the seed or flat. Wait a few months, preferably through one winter, and the chances are that it will grow. There are records of primrose seeds, for example, that showed no signs of life until the third spring after planting.

Hard Seeds

Some species have what are called hard seeds. These are particularly common in sweet peas. These are alive and will grow if only we can force moisture through the hard seed coat. In some instances, freezing is the only practical way to make them sprout. In others, fungi and bacteria have to digest the seed coat. An excellent example of this is *Aconitum fischeri*, one of the monkshood species. We have never been able to get a test of this in the laboratory because we keep equipment sterile.

Some seeds are not fully mature when they drop from the plant. These seeds must be exposed to low temperatures (below 42° F.) but above freezing.

Light Effects

The role of light in seed germination is fascinating. Some seeds simply won't sprout if you give them any kind of a cover. Bluegrass is an important example. One reason why bluegrass is slow to germinate is that most people rake it into the surface and the seed is not able to germinate until rain has washed away most of the cover.

Bluegrass is an example of another phase of germination which needs to be understood. Most gardeners expect close to 100% germination. Yet, if even 10% of the bluegrass seed sown did germinate, they would be in trouble. Experts recommend sowing a pound to 200 square feet, more than ten thousand seeds per square foot. Yet all we need for a good stand are forty plants to the square foot. Obviously, seeding under lawn conditions means high losses with low germination. We must sow thousands of seeds so that only a few will enjoy the optimum conditions favorable to germination.

A number of common seeds must have light for germination. Thyme, most of the grasses, the artemisias, endive, most (but not all) of the lettuces, achillea, gloxinia, and all begonias are only a few of the species that come to mind.

Carbon Dioxide

Soluble salts and gases in the soil are also factors. Certain hard-to-keep seeds can be preserved practically indefinitely if immersed in an atmosphere of carbon dioxide.

Carbon dioxide can prevent seed germination in soil also. For example, a woman wrote us that we had sold her a bunch of junk. Her seeds had been planted under perfect conditions, generously fertilized, yet not one seed had even sprouted. She had put zinnias and larkspur in the same frame, along with a miscellaneous lot of material that simply couldn't be expected to grow under the same conditions, but she was sure that only the seed could be at fault.

In my reply, I pointed out that soluble salts in soil did have a harmful effect on seeds, and in high concentrations fertilizers would destroy seedlings before they could break through.

I got an indignant letter back stating that she was no fool: no chemical poisons for her. She had dug a 5-foot pit, filled in 4 feet of good cow manure and covered it with 6 inches of soil. Her seeds had been planted in that wonderful soil and had failed.

You can imagine that hotbed. Only a farmer inured by years of barn work to ammonia fumes could survive a whiff of it. Because carbon dioxide can't be detected by smell, there would be no way to identify it, but, if a CO_2 recorder were available, it would probably show a higher concentration than found in the chimney of a well-regulated oil burner. No gardener would think of running the fumes from his oil burner through a hotbed to heat it, but the fumes of fresh manure will do just as much harm.

The demand for "fresh seed" is universal. No one seems to realize that the seed sold in the spring of 1955 could not have been harvested that year, but came from the crops of 1954. There *is* a difference between freshly harvested seeds and those stored dry from fall until the following spring. Oddly enough, most of these differences are in favor of the older seed.

Dry stored sweet alyssum seed, for example, germinates easily if a temperature of 68° F. is maintained. But if we sow fresh seed, it must first be chilled to 42°, then raised to 68°. Then it sprouts in a hurry. A number of species display this same peculiarity, including antirrhinum, candytuft, carnation, dianthus, larkspur, lupine, *Phlox drummondi* (perennial phlox must be frozen), stock, and sweet pea. If you are saving your own fresh seed of any of these, be sure to give them cold treatment before sowing.

TREES AN ECONOMIC ASSET

Reprinted from *Business Week,* July 23, 1955

Trees are an important physical and financial asset if you plan to buy or sell a house.

Real estate authorities say that homes with trees generally sell faster and at a higher price than comparable property with no landscaping. Thus if you plant trees on your property, there's a good chance of your getting back what they cost when you sell.

Furthermore, you can get a tax break as the result of planting trees. Internal Revenue Service considers landscaping a permanent improvement to a home. So when you sell, you can add the cost of any trees you have planted (as long as it's within reason) to the initial cost of your house. This lowers your capital-gains tax.

What about buying a house that already has trees around it? You may pay more—but you also may be able to get a higher mortgage. That's because the property probably will be appraised at a higher value than property without trees.

Not all trees, of course, have an effect on the value of property; it depends to a great extent on their size, type, and the location in which you live. However, experts say that it's fairly safe to assume that you will get back any investment in trees that runs between 3% and 4% of the total value of your property. Finally, you'll probably have less trouble selling a tree-shaded home.

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* * *

WATCH OUT FOR THESE TWO RACKETS

E. J. Davis, writing in *Garden Talks,* organ of the Chicago Horticultural Society, warns gardeners not to be misled by claims of high-pressure salesmen of two common garden fetishes—black soil and earthworms.

In the minds of many gardeners, the words "rich" and "black" are associated together when soil is thought of. While it is true that many rich soils are also black, this does not necessarily follow. There are many rich soils that are not black, and there are black soils that are not rich. Swamp mucks are often good examples of the latter. To sell soil as rich merely because it is black, without regard to its actual plant nutrient content is a racket, and one that is too frequently practised. In buying soil so described, the buyer should demand the guaranteed chemical analysis. The salesman will be glad to give this information if the analysis has been made. If not, be on your guard.

The earthworm racket, according to Mr. Davis, is another which prospers because of a misunderstanding of cause and effect in the minds of many gardeners. The claim is made that the addition of earthworms to soil will improve that soil. As Mr. Davis says, this is an insult to the mentality of the earthworm, because no self-respecting earthworm is going to stay in poor soil. Earthworms put in poor soil soon disappear—some move to better soil; many starve to death.

Earthworms feed upon the organic material in the soil, and in passing through the bodies of the worms, this material may be made more available to plants. But if, as in the case of many poor soils, there is little or no organic matter present, the earthworms cannot put it there.

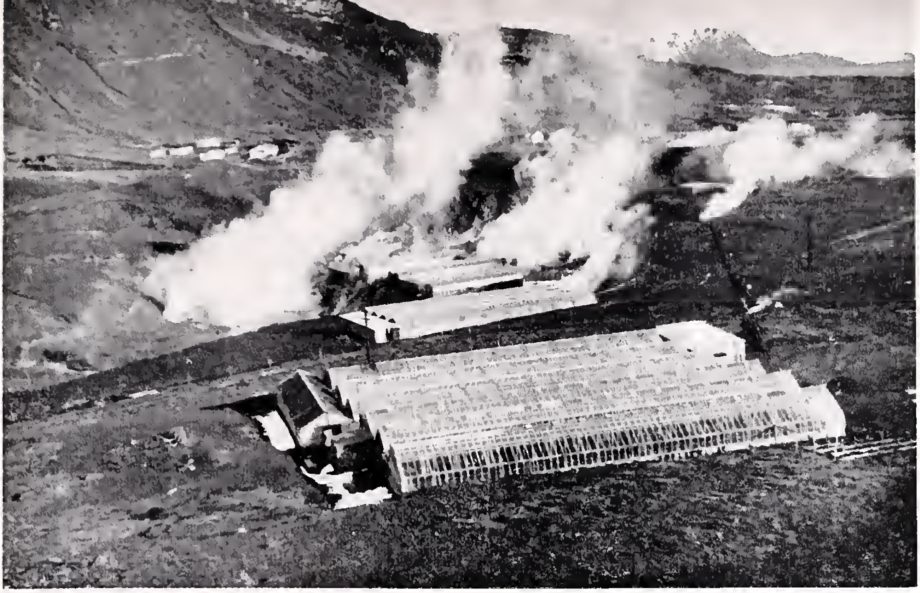
The wise thing to do is to add organic matter to the soil in generous quantities. Then very likely you will find that the earthworm population will take care of itself.

Iceland's rivers rush down from melting glaciers. Near this spot the ancient Icelandic parliament assembled each summer for nearly a thousand years.

SUMMER SCENES IN ICELAND AND NORWAY

George S. Avery, Jr.

Hot springs and geysers are common in the volcanic residue that makes up treeless Iceland's 40,000 square miles. Here the hot water is piped to a nearby settlement, for heating homes and greenhouses.



Josepsson

Near the village of Hveragerthi (pronounced quer-a-gair'de) are great ranges of greenhouses. These as well as homes are heated by the hot springs. Earth tremors are common in this agricultural district where dwellers run the risk of having unexpected hot water come up through the floor.

Tomatoes and cucumbers are the chief "fruit crops" grown under glass.

Author photos

Special treat for a visitor—banana from one of the 200 greenhouse-grown banana trees.

Icelanders are fond of flowers, and grow roses, carnations, chrysanthemums and pot plants—though greenhouse space is at a premium. Calla lilies are grown for export. Outdoor and/or coldframe crops are limited to potatoes, cabbage, carrots, cauliflower and turnips.

Farms of Norway dot the sharp slopes of mountain valleys. Roads to the higher mountains are steep and narrow, but rarely precarious.

The picture above was taken near Singsås, where farmland is about half in forest. Holdings average some 9 acres each, and the principal crops are hay, barley, oats, and potatoes.

Here and there on higher slopes (in the distance, below) are snowfields that melt slowly, keeping large mountain areas wet in summer. But whether the mountains are wet or dry, there are hundreds of kinds of alpine plants, mostly dwarfs—one rock garden merges into another.

Across this bridge in the high country go horsecarts, cows, sheep and people.

Author photos

Evening sun in mid-July sidelights settlements of mountain huts a mile away. Sod-roofed hut at right was "home". Each of the settlements is called a Seter.

Seters and the grazing rights to endless mountain pastures around them belong to farmers in the lower valleys. The huts and pasture rights stay in families for generations; are used for a few weeks each year.

In the mountains above and beyond the Seters, the seasonal stage of a plant's development depends on where it grows. Within a snow patch the buds of dwarf birches were tightly closed and still winter-dormant in mid-July. At the edge of the snow, buds were swelling; 10 feet up a slope from the snow the expanded leaves were those of midsummer. Winter to summer in a distance of 15 feet!

3-inch high moss-like heath with pink flowers is Phyllodoce (*P. caerulea*).

Handsome little mouse-eared chickweed of the mountains (*Cerastium alpinum*). →

A taste of salt and this half-wild ewe became a persistent friend, willing to ← pose for a close-up.

Close relative of the bunchberry of North America is this native of the Norwegian mountains, *Cornus suecica*.

Author photos

Japanese garden is "natural" rather than formal, but it does permit artistic expression by the designer in his skillful blending of rocks, water, and plants.

I BUILT A JAPANESE GARDEN

Edward M. Bratter

Condensed from the *Garden Journal*, March-April, 1955

I have recently completed a Japanese-type outdoor garden. The planning and building of it have given me so much pleasure that I am eager to share my pleasure and my acquired but incomplete knowledge.

I should like to emphasize that I do not pretend to be expert. To be expert in this field requires years of contact with the theory and symbolism which have developed during more than one thousand years in Japan, where gardening has occupied a much more important place in the national culture and every-day life than it has in the western world. In Japan, gardening is one of the really serious arts—has been ever since olden days when the samurai, or warrior class, were its chief patrons.

However, I am convinced that it is not

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Soichi Sunami photos

Windswept pine is an important element in the overall design of the author's Japanese garden.

necessary to be expert in the history and symbolism of Japanese gardens in order to build one here in the United States, or to enjoy one.

Japanese flower arrangement is becoming more widely accepted. Likewise, I believe that the Japanese-type garden will become more popular as more people become acquainted with its beauties and possibilities. The Museum of Modern Art of the City of New York has recently built such a garden as an adjunct to its Japanese exhibition house. The Brooklyn Botanic Garden has had an authentic and extensive Japanese garden for more than 40 years. Many Japanese trees, shrubs, and flowers have been successfully transplanted to the United States because of the similarity in climate and have become commonplace.

To many of us, the words "Japanese garden" mean the miniature type of dish garden generally available at florists, replete with miniature curved bridge, tiny animals, and the like. While this type of miniature garden has many attractive possibilities, usually it is not even a miniature of the kind of outdoor Japanese garden which I am about to discuss.

When I decided to build a Japanese-type garden I had never seen one. However, I had read some books, and, more important, I had seen the illustrations contained in these books, and I had some familiarity with Japanese flower arranging. I came to the conclusion that this type of garden would give me a lot of garden in a relatively small space, with reasonable annual maintenance, and that it would give me a "kick" or stir in the blood to build and then enjoy it. I am glad to say the realization has been up to my expectations in all respects.

With this type of garden, there is the opportunity to accent some features, such

Soichi Sunami

Stone lanterns, pagodas, and other accessories are desirable but not indispensable features of Japanese gardens.

as natural stones, water, shape of trees, and to minimize or even eliminate others, such as lawn and flowers, so that even though the garden remains "natural" rather than formal, it still permits personal artistic expression by the designer. In other words, it is not a replica of a natural woodland scene but rather a shaping of the elements found in nature, particularly rocks.

What is a Japanese-type garden? Implicit in my definition are the reasons which prompted me to build one. I describe it as a garden in which

(1) the design is more important than the variety of plant material;

(2) the topography, rocks, and water or simulated water are highly important elements of design;

(3) there is a minimum of symmetrical, geometrical, or formal shape;

(4) the major emphasis is to create the impression of a scene which might be found in nature, but not a replica of an actual scene, including a series of compressed vistas in a relatively limited area;

(5) there is usually included, in addition to a pond, an island and a waterfall (or a simulated river bed)

(a) rocks of such size, shape and placement as to create certain impressions (apart from the old-time Japanese symbolism);

(b) stepping stones chosen with an eye to design and placed so as to require slow, watchful, and deliberate walking through the garden in either zigzag or "sea gull" style or in "scattered island" design;

(c) trees chosen primarily for shape, with one or more having a windswept or grotesque appearance indicating age and success in meeting the onslaught of wind and weather, and with the majority of trees and shrubs evergreen so as to permit year-round enjoyment;

(d) gravel or sand (either raked for design or natural) heightening the effect of the water and bridging the gap between the rocks and the earth;

(e) minimum or absence of flowers, color interest being primarily afforded by the various shades of green and the differences in texture of leaves (where flowers are desired, plants are usually grown in pots which find a place in the garden only while in flower so as to avoid the sight of dead blossoms);

(f) no lawn—instead moss, other groundcovers, and sometimes bare earth;

(g) places to sit and enjoy the scenes—sitting stones, benches, garden house, or possibly a tea house (a tea house is a project by itself and is by no means a necessary accessory);

(h) one or more fences or arbors, possibly of bamboo and of open design;

(i) one or more Japanese stone lanterns and possibly a stone pagoda (while these are generally used, I do not believe them to be indispensable);

(j) a bridge where it provides a vantage point and does not appear to be too artificial or contrived;

(k) an entrance gate (in my case, I chose to use a hedge of *Ilex bullata* as more appropriate).

"Beauty is in the eye of the beholder." The Japanese-type garden has given me what I wanted—a garden which is pleasant to behold—which evokes a feeling of nature at rest—a place in which to reflect and relax.

Books on Japanese Gardens

Even if you do not intend to build a Japanese-type garden, you may enjoy reading about them and seeing pictures of some of these highly developed, imaginative creations of gardening artistry.

Currently in print and available at many book stores are the following:

1. *Japanese Gardens* by Professor Matsunosuke Tatsui, published by the Japan Travel Bureau in Japan, 1952—70 pages 5¼"x7¼". An excellent summary of the history and theory with some illustrations.

2. *A Thousand Years of Japanese Gardens* by Samuel Newsom, Tokyo News Service, 1953—318 pages, 7½"x10½", profusely illustrated with photographs.

3. *Art of the Landscape Garden in Japan* by Tsuyoshi Tamura, Kokusai Bunka Shinkokai (Society for International Cultural Relations), Tokyo, 1935. Reprinted in 1947 in paper cover with relatively poor printing—245 pages, 8"x 11", well illustrated with drawings and photographs, and a complete chapter on the materials required.

4. *Japanese Garden Construction* by Samuel Newsom, published by Domoto, Kumagawa, and Perkins in Tokyo, 1939—302 pages 9"x11½", of detailed information and of great value to anyone intending to construct a Japanese garden. This is quite scarce.

Practical Suggestions for Building a Japanese Garden

Once again may I confess that my knowledge falls far short of my eagerness to share with others my pleasure in planning, building, and living with a Japanese garden. It is my purpose in these pages to present an outline of procedure, with a view to stimulating others to undertake such a garden after they have acquired more knowledge through a study of one or more of the books described.

When I came to the conclusion that I wanted to change my conventional type rock garden and lily pond into a Japanese-type garden, I decided to seek the assistance of a landscape architect or gardener familiar with Japanese gardens. I was fortunate in locating T. Ito of Nippon Shoji, 501 East 82nd Street, New York City. On the West Coast, Samuel Newsom, of 19 Sunnyside, Mill Valley, California, author of the recommended books, *A Thousand Years of Japanese Gardens* and *Japanese Garden Construction,* is available. While I believe the assistance of an expert is desirable and will represent economy in the long run, it is by no means indispensable.

The skeleton of the garden is all important and a detailed plan of eventual grades, location of pool and waterfall (or simulated river bed) and principal rocks, is essential if lost motion is to be avoided. The plan should include a sequence of the various steps so that the construction of the pond, changing of grades, and moving of trees do not interfere with each other. Since a limited area is usually put to maximum use, the danger of collision of the various steps is greater than usual and careful advance planning is advisable.

Sequence of construction would probably follow this order: (a) rough grading; (b) construction of pool and waterfall; (c) placement of island in pool; (d) placement of larger rocks; (e) water lines for pool or built-in sprinkler and electrical lines, if required for pump or lighting; (f) finished grading; (g) stepping stones; (h) placement of lanterns and construction of benches, garden-house, and fence; (i) trees and shrubs; (j) moss and other groundcovers; (k) pebbles.

Plant Material

A wide variety of trees and shrubs is eligible. The chief problem is locating one or two evergreens of windswept shape. Nurseries usually do not carry such items, though an old established nursery may have them.

I made extensive inquiry and finally acquired a weeping blue spruce of the desired shape from Detmer Nurseries, Tarrytown, New York. This nursery was originally established as the private arboretum of Julian Detmer and includes some unusual plant material. A pine was growing in an empty lot not far from my residence; it had been "topped" years ago and as a result had a windswept shape. It cost me nothing but the labor of moving. Before I found it, I had planned to get a tree from a mountain top or near the sea. The shapes of these two trees are an important element in the over-all design of my garden, and I do not regret the efforts involved in locating them.

The only other item which is not generally available commercially is moss. Of course, it can be collected in the woods, but the moss used in mine came from Mrs. E. K. Hammond, Split Rock Road, R.D. #2, Boonton, New Jersey, at a cost of $6.00 a bushel. This is enough to cover about 16 square feet. I also purchased meadow moss and ferns from Isaac Langley Williams, Wild Flower Gardens, Exeter, New Hampshire.

Water Features

If you intend using a pool, I suggest a reinforced concrete pool of irregular shape with a built-in drain. Because generally it is difficult, if not impossible, to get a water-tight joint between natural stone and concrete and because many natural stones are not water-tight, I suggest building a complete concrete pool with vertical or almost vertical sides and then covering the walls with natural stones or cypress. In order to conserve water, I installed a recirculating pump (Ingersoll Rand—No. IKRVS—¼D, which is rated to deliver at least 5 gallons a minute against a 15-foot head and a distance of one hundred feet). I used ¾-inch plastic pipe to bring the water from the pump to the top waterfall. Plastic pipe is inexpensive and, because it is reasonably flexible, it is easy to lay.

Where water is not feasible, the illusion of water can be created by making a dried river bed—using rocks, pebbles, sand, and appropriate plant material. The illusion of water can also be had by using sand to simulate a beach with occasional rocks. The imagination of most garden lovers is vivid enough to create the impression of water.

Accessories

On the East Coast, Japanese lanterns, pagodas, and such accessories are not generally available. Although, as indicated above, lanterns are generally found in Japanese gardens, I believe a Japanese-type garden is possible without such accessories. They can be added later.

I have three stone benches made of natural flat stones found in old farm walls, approximately 6 to 8 feet long. Apart from the labor of hauling them and a trifling mason's charge, they cost me nothing.

My garden-house is 13 x 16 feet, constructed of natural cedar log uprights, white pine, redwood, and bamboo. The design follows a drawing in Conder's book. I wanted a simple structure, not only because of cost considerations, but because I did not wish it to be too important in size.

Usually there is a gate entrance to the Japanese garden. I did not use a gate, because on one side there is an *Ilex* hedge and on another side two Japanese cut-leaf maples to frame the entrance. A third side I left as it was, except that I substituted ivy for flowers; and on the fourth side I built a fence of cedar with a characteristic irregular, rough design.

A Japanese garden lends itself admirably to illumination, which produces light-shadow silhouettes and reflections of great interest. In many ways a garden illuminated at night is different from what it is in the daytime. Lighting is an art in itself. The object is not to flood light but rather to have spots of light, concealed, if possible, and with predetermined coverage.

Cost

On a square foot or area basis, a Japanese garden is more expensive to construct than a conventional garden, largely because of the cost of moving sizeable stones. However, there is an offsetting factor in the probable lower maintenance and greater permanence.

Hints On What To Avoid

Avoid showing cement as much as possible—wherever feasible, have adjoining stones of appropriate shape, color, and strata.

Avoid plant material which is of too rapid growth because, even with heavy pruning, it may be difficult to keep the original shape and size.

Avoid plant material which may not prosper in view of weather—sun and water available.

Avoid moving heavy stones without enough experienced manpower. One man too many is generally advisable.

Avoid overdoing stone work and overcrowding plant material—remember space is an important element in design.

While a bridge is something to be desired, it may be difficult to find a suitable location, it may be out of scale with the rest of the garden, and instead of providing a good vantage or resting point, it may cut the design. Although I wanted a bridge over my pond, I settled for stepping stones because it was better from the viewpoint of design.

While a gate or hedge emphasizes the entrance to the garden, consider an approach which gives a gradual transition, such as a Japanese cut-leaf maple, fence of appropriate design, or an informal shrub planting.

Garden house, Japanese in conception and structure, fits admirably into setting of evergreen shrubs. Grotesque outline of Japanese maple against massive rock is also in keeping with Japanese artistry.

Soichi Sunami

SYSTEMIC INSECTICIDES

Approach to pest control

P. P. Pirone

Condensed from *Flower Grower*, August, 1955

Systemic insecticides may soon drastically change our present pest-control practices. These chemicals are absorbed either through the roots or leaves of actively growing plants in sufficient amounts to kill insects and related pests feeding on or breeding in them. They are effective even at considerable distances from the point where they are applied. They make possible the control of pests, such as root aphids and leaf nematodes, which spend some or all of their lives in areas not readily accessible to standard surface sprays.

Early Attempts

Systemic insecticides as we know and use them today were developed only recently. Among the earliest studies on internal therapy of plants were those in the middle 1920's by Adolf Muller, who found that pyridin was a plant therapeutant for insects. About 10 years later, Gerhard Schrader and his associates noted that certain toxic compounds could be absorbed through the roots and leaves of plants and thus protect them from insect attack. An organic phosphate, octamethylpyrophosphoramide, was one of the first found to have this unusual property. This compound is also known by the names OMPA and Schradan.

Chemicals Used Today

At present two organic phosphates are perhaps the most widely used systemic insecticides. These are known by the common names Demeton (trade name Systox), and Schradan (Pestox 3 and OMPA). These are used mostly as soil drenches to control aphids and mites on a number of important ornamental plants—roses and chrysanthemums grown outdoors and on many ornamental plants grown under glass.

On outdoor roses and chrysanthemums, Systox is used at the rate of one liquid ounce, well-diluted with water, for each 100 square feet of flower bed.

Following are the basic dosages of the systemics for use on greenhouse ornamentals:

For chrysanthemums and carnations, 1 pint of 21-23 per cent Demeton (Systox), or 2 pints 90 per cent Schradan (OMPA) per 1,000 square feet of bed area.

For African violets, cyclamen, delphinium, and foliage plants, 2 pints 21-23 per cent Demeton (Systox), or 2 pints 90 per cent Schradan (OMPA) per 1,000 square feet.

Sufficient water must be used to assure good distribution through the soil.

Use on Food Crops

Although Systox was first used primarily for the control of pests on ornamental plants, it became the first systemic insecticide to be approved for use on

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food crops. At present its use in this country is permissible early in the growing season on apples, potatoes, and English walnuts. In Europe its use is permitted on an even wider range of edible crops.

One reason for permitting the use of Systox on certain food crops is that it does not last long after it gets inside the plant. It breaks down so rapidly inside the plant that the residues are essentially non-toxic. It remains effective for a maximum of 3 weeks, or long enough to destroy the insects against which it is applied.

Systox is harmless to bees unless they are hit directly with it.

Spray Applications

Some of the newer systemics can be applied as foliage sprays. One investigator found that 69 per cent of the Schradan applied to bean leaves entered within 14 hours. Another found that 50 per cent entered citrus leaves within 24 to 48 hours of the foliar application.

Obviously, the less toxic an insecticide is to humans and pets, the more extensive its application.

The first such systemic to be developed is Meta-Systox which is far less toxic to test animals (rats) than Systox, but it must be used at twice the strength to achieve the same degree of aphid and mite control.

Selenium Compounds

About the time that Schrader began his investigations, two United States Department of Agriculture research workers, A. M. Hurd-Karrer and F. W. Poos, discovered that selenium compounds could be introduced into plants via the roots in sufficient quantities to protect plants against certain insects. They grew cereal crops in soils containing ten parts of selenium (as sodium selenate) in a million parts of soil and noted that aphids which fed on these plants soon died.

Other research workers then found that about 100 parts per million of sodium selenate in plants would control all red spiders and that less than half this amount could be used to control aphids.

Soon it was discovered that selenium absorbed by chrysanthemums would also control the widespread and highly destructive leaf nematode.

The use of selenium as a systemic insecticide for controlling aphids, mites, and leaf nematodes *is absolutely restricted to ornamental plants. It should never be used on plants that are to be consumed as food by man or animals.* Moreover, soils on which it is used cannot be used to grow food crops for many years.

Sodium selenate, is the form most commonly used to treat ornamental plants. It must be handled with the greatest of care.

It is prepared and used as follows: First, dissolve 1 ounce of sodium selenate crystals in a gallon of water and label the jug "Sodium Selenate Concentrate, Poison!" To use, dilute one-half pint of this concentrate in water to make 1 gallon of diluted mixture. Sprinkle 1 pint of this diluted mixture to each square foot of flower bed. A gallon of this diluted solution will therefore treat 8 square feet of bed or 8 plants. *After* treating with the diluted sodium selenate mixture, sprinkle the treated area with plain water and keep the area well watered during dry spells.

The treatment should be repeated on the same plants or in the same beds 3 to 4 weeks later.

Sodium selenate is also available in capsule form under the name Kapsulate, for the control of pests of African-violets, and in a 2 per cent concentration, absorbed on superphosphate, under the name P-40, for direct application to soils in which chrysanthemums are growing.

Systemic insecticides, particularly sodium selenate, have proved most effective on vigorously growing herbaceous ornamentals. They are less effective, however, on woody plants and slow-growing nursery plants and trees.

ANTIBIOTICS AGAINST PLANT DISEASES

Recent experiments show that antibiotics control rot, blight, smut, wilt, mold, and mildew in some plants

David Pramer

Condensed from *The Scientific American*, June, 1955

ANTIBIOTICS have been a great gift not only to medicine but also to agriculture. They are used today to promote the growth of pigs and chickens, to prevent spoilage of vegetables, dairy products and sea foods, to delay deterioration of beef, even to preserve food by incorporation in the ice used to chill it.

During the past year the possibility of using antibiotics to control plant diseases was explored in many laboratory and field studies. The results reported by agricultural experiment stations throughout the country are most promising. This new and intriguing approach to the problem of reducing plant disease losses has given rise to questions of fundamental importance to the microbiologist and plant physiologist, as well as to the plant pathologist.

In the United States plant diseases are attacked in four ways: exclusion, eradiation, plant breeding, and chemical treatment. The Federal Government, most states and some counties take steps to prevent diseased plants and animals from crossing their borders, and an outbreak of disease may be localized by quarantining the infected area. Eradication of an established disease may be achieved by destroying infected plants, by crop rotation, by elimination of alternate host plants or by soil management which discourages growth of the infective organisms. Breeding is used to produce disease-resistant crop varieties. And more than 200 million pounds of chemicals, costing $35,000,000, are expended in the United States each year to fight plant diseases.

The poisons most commonly employed for preventing plant disease are compounds of sulfur, copper and mercury, with carbamates and certain other chemicals recently added to the arsenal. In general these defenses protect plants only at the surface. It has been difficult to find chemicals which will destroy specific bacteria or fungi within a plant without injuring the plant's tissues also. Now the antibiotics have made such attack possible.

Fireblight

One of the most promising experimental successes of the antibiotics has been against the bacterial disease of apple and pear trees known as fireblight, long the despair of orchardists. The fireblight damage to orchards is estimated to be millions of dollars annually, and it is responsible for the marked decline of pear culture in our eastern and central states. The disease is spread by pollen-gathering and nectar-sucking insects as they move from infected to healthy blossoms. Once in the blossoms, the fireblight bacteria multiply rapidly. The blossoms, leaves and branches turn brown or black, as though seared by fire. The infection lies dormant in the woody portion of trees throughout the winter and reappears the following spring. Copper sprays and dusts have been used against it, but they

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are only moderately effective and damage the fruit and foliage.

Among the groups that tested antibiotics against fireblight was R. N. Goodman and his associates at the University of Missouri Agricultural Experiment Station. They applied various antibiotic-containing sprays to the foliage of year-old fruit trees that were extremely susceptible to fireblight. To help the drugs penetrate into the leaf tissues they added methyl Cellosolve, a cuticle solvent, to the spray. Twenty-four hours after the spray was applied, the trees were infected by inoculation of the shoots with fireblight bacteria. The experimenters discovered that a spray containing streptomycin and terramycin could give almost complete protection against fireblight. The drugs acted to suppress the bacteria inside and at the surface.

Orchard experiments on naturally infected trees confirmed these greenhouse results, and so did tests at various other stations throughout the country. Antibiotics promise to become a routine treatment for the control of fireblight.

Vegetable Crop Diseases

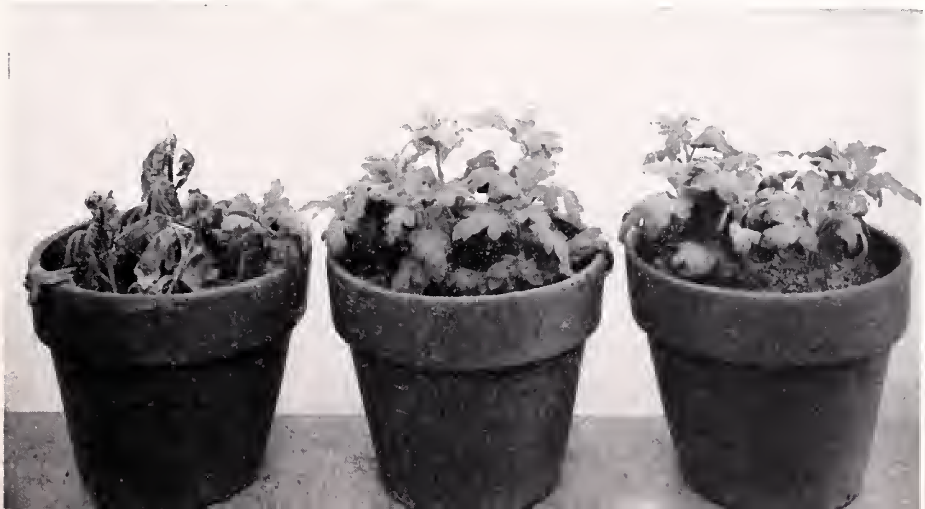
Many other workers investigated the potency of antibiotics against diseases of vegetable crops. At the Bureau of Plant Industry of the U. S. Department of Agriculture, J. W. Mitchell and W. J. Zaumeyer collaborated in treating bacterial blight of beans. This embraces a group of diseases: common blight, fuscous blight, and halo blight, each caused by a different bacterium. They are promoted by a rainy season. Water-soaked spots appear on the leaves and pods of infected plants. The spots enlarge and turn brown, and the dying leaves may become covered with a bacterial ooze. The bacteria enter the plant through the stomata in leaves, stems, and pods.

Mitchell and Zaumeyer prepared a paste of streptomycin mixed with a lanolin carrier and applied the paste in a thin layer on the stems of bean plants. The stems absorbed the drug and passed it on to the leaves: measurable amounts of the antibiotic were detected in leaves within eight hours. This treatment was completely successful in preventing blight in bean plants inoculated with the halo blight organism.

A farmer cannot be expected to go through acres of bean plants treating each stem individually, as the experimenters did in this laboratory test. Mitchell and Zaumeyer therefore proceeded to spray fields of beans with a preparation containing one tenth of 1 per cent of streptomycin. Four sprayings completely prevented the blight. The streptomycin spray

Chrysanthemum cuttings below were inoculated with bacterial wilt. Pots in center and on right treated with streptomycin. Pot on left received no treatment.

Author Photo



was able to suppress the disease even after infection appeared, if the spray was applied within 2 days of the infection.

At the Wisconsin Agricultural Experiment Station C. Leben and G. W. Keitt worked with a new antibiotic called helixin. It is primarily a fungicide, and the experimenters demonstrated that it could control a fungus-incited disease of tomato plants known as early blight. The blight first produces small brown spots on the leaves and then causes the leaves to turn yellow. Much of the foliage dies. Helixin, sprayed on the plants, reduced infection by more than 95 per cent. It acts only on the plant surface: immersing the roots of tomato plants in solutions of the antibiotic had no effect on the infection.

Streptomycin Checks Chrysanthemum Wilt

Antibiotics have also scored successes against certain diseases of flower plants. A study of their usefulness for control of bacterial wilt of chrysanthemums was undertaken at the New Jersey Agricultural Experiment Station. Bacterial wilt, a new menace to chrysanthemums, has become serious in commercial nurseries. The infection is believed to have been spread throughout the country in cuttings, the usual form in which chrysanthemums are propagated. The infecting bacterium invades the plant's sap vessels, causes them to turn a reddish color and eventually may produce a black, soft rot of the stem and leaves. Streptomycin, aureomycin, and terramycin proved to be most active against this bacterium, but the latter two were toxic to the plants.

Streptomycin was effective as a protective measure when applied to cuttings before infection. And it gave a high degree of control and protection against the disease when the antibiotic was applied to the sand in which the cuttings were grown instead of to the cuttings themselves. Thus streptomycin, which at the current price is not appreciably more expensive than some sprays commonly used in greenhouses, seems to be a practicable means of prevention and treatment of bacterial wilt of chrysanthemums. It is up to 80 per cent effective even against severe infections and does not set back the plants.

These are only examples taken from what is rapidly becoming a voluminous literature on the usefulness of antibiotics against plant diseases. In almost every test the results have been most promising. Two large pharmaceutical firms have announced that they will market antibiotic plant sprays this year.

Opportunities for Experiment

The unusual ability of antibiotics to enter the plant system has provided an opportunity for some interesting basic studies of the migration of substances in plants. The writer made a series of such studies during a two-year stay in England. The experimental procedures employed were relatively simple. Plant roots or cuttings were immersed in antibiotic solutions, and the amount of antibiotic taken up was then determined by measuring the concentration in sap pressed out of the leaves.

In one experiment cucumber seedlings were used to study the uptake and movement of five antibiotics. The seedlings absorbed no aureomycin, neomycin, or terramycin, so far as we could tell. They absorbed considerable chloromycetin, but the level in the leaves never reached that in the solution in which the roots were immersed. Streptomycin, on the other hand, was so effectively absorbed and stored that the concentration in the leaves was actually higher than that in the solution feeding the roots.

Antibiotics travel in the plant more slowly than minerals or plant hormones. Their absorption and rate of migration in the plant seem to be linked with the evaporation of moisture from leaf surfaces (transpiration). This is of practical interest, for it indicates that the effectiveness of antibiotics in plants may be profoundly influenced by atmospheric or weather conditions.

There is indirect evidence that some antibiotics will penetrate into a plant when they are applied to the surface in a spray. But that is a separate subject which still needs much more study.

How Antibiotics Work Still Unknown

How do the antibiotics act to halt disease in a plant? The answer may seem obvious (by attacking the microbe), but actually it is still largely unknown. One of the mysteries is that infectious organisms which resist an antibiotic in the test tube succumb to it in a plant. For instance, streptomycin has little or no activity against fungi *in vitro*, but it unexpectedly controls blue mold of tobacco, loose smut of barley and rot of sugar beets—all fungus diseases. Likewise streptothricin and terramycin suppress two plant virus diseases—tobacco ring spot and tobacco mosaic—although they show little effect on viruses in the test tube.

Difficulties

Although we know little about how antibiotics work, we do know that they can be remarkably effective against plant diseases. Two major difficulties stand in the way of their commercial application. One is economic—the cost of antibiotics. However, the one antibiotic that is the best choice against almost all the diseases is streptomycin, which is also the least expensive. J. C. Dunegan of the U. S. Department of Agriculture has estimated that at its present price of 20 cents per gram, commercial use of streptomycin to control fruit diseases approaches feasibility. No estimate has been made as to whether it is economically practicable for vegetable and floral crops.

The second difficulty involves public health. If the crops we eat contain antibiotics, we must be concerned about whether they will contribute to developing resistant strains of bacteria in our bodies, so that the antibiotics will be less effective in controlling human infections. The use of antibiotics for treating human diseases is more important than their use in controlling plant diseases. It will be necessary for the U. S. Department of Agriculture and the Food and Drug Administration to establish permissible tolerances for antibiotic residues in food crops.

* * *

CRABGRASS KILLER

A new chemical killer for crabgrass shows extraordinary promise of being the long sought for control. According to R. Milton Carleton the new chemical, Sodar, offers the best and fastest control of crabgrass yet available. Tests indicate that it is harmless to many perennial grasses. It has been used safely on bluegrasses such as Kentucky Blue and Merion, also on bentgrasses and fescues. Zoysia and Bermuda grass are likewise unharmed.

In addition to being fast acting, Sodar has little or no residual effect, permitting reseeding of treated areas only 2 or 3 days after treatment. This was not possible with many of the older chemicals.

There is evidence that the new chemical is also effective against common chickweed (*Stellaria media*), knotgrass (*Polygonum aviculare*), and purslane (*Portulaca oleracea*) as well as the annual grasses such as crabgrass (*Digitaria*).

To completely free a lawn of crabgrass two applications of Sodar are recommended. The second one is to catch late seedlings—Sodar does not kill crabgrass seed.

Carleton issues one or two warnings concerning the chemical. Sodar is the short code name for disodium-monomethyl-arsonate. Since it has an arsenic base, it cannot be considered a harmless compound. Ordinary care in its use should obviate any danger. Like all other crabgrass killers, Sodar may injure a freshly planted lawn. Until they have been mowed a few times and the plants have formed crowns, perennial grasses act like annuals with respect to most weedkillers.

Ben Korter

Nematodes, enlarged approximately 100 times. Their actual length is only about 1/16 of an inch.

KING OF THE PESTS

The nematode has neither brains nor eyes, yet he is costing American agriculture a tenth of all it grows

Norris Leap

Excerpts from an article in *The Saturday Evening Post*, October 15, 1955

Reprinted by special permission of *The Saturday Evening Post*
With additional illustrations

SINCE the beginning, we humans have bragged that we were the brainiest things alive. Now it turns out that we were being outsmarted by a worm that hasn't a brain in its head. Usually this worm is about as big as a grain of salt, but it comes in a thousand shapes and sizes.

The worm is the nematode, and only lately have we taken a close look at it. The look has been eye-opening. It shows that all through the centuries this brainless worm has exacted from us brainy humans a yearly tribute that would make a king's ransom look like play money.

The nematode has laid waste groves of

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citrus trees. It is weakening orchards of deciduous fruits. It is sapping the vigor of cotton on millions of acres. It has banished sugar beets from ideal sugar-beet land. It has thrown a Grade A scare into potato men. It has cost a single citrus setup in California more than $1,000,000. It has despoiled tobacco seedbeds and fields of growing tobacco. It has cost almost entire crops of bulbs of commercial growers in Oregon. In California it is besieging 1,000,000 acres of vineyards. It has ravaged truck gardens from Florida to Michigan and from New York to California.

Every state in the union has been hit, and every agricultural county in some southern states and California.

All of this has led to a war against the worm, a war which began in a quiet way many years ago. It's a war which has brought its moments of triumphs to us humans, but more often has been just baffling, exasperating, and expensive.

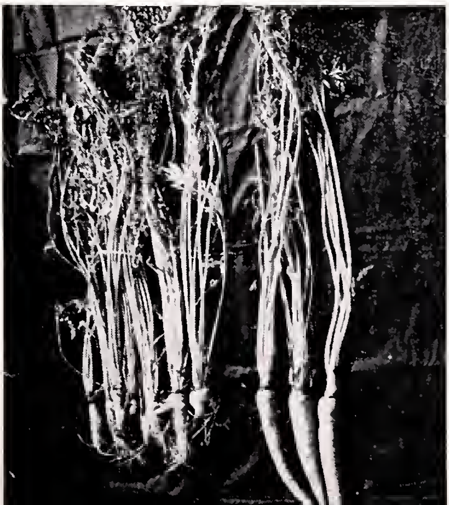
Few people have seen a nematode, but almost everyone has seen its handiwork. Didn't you ever see a carrot with "whiskers"—one with a messy growth of rootlets? Or a bewhiskered beet or turnip or parsnip, ugly with knobs and ridges? Didn't you ever try to grow a prized rosebush or gladiolus or iris or African violet? And no matter how many sprays you used or how much fertilizer and loving care you gave it, the thing just wouldn't flourish? Yes? Well, your trouble could be nematodes.

Long ignored as one of the relatively harmless plant parasites, the nematode has been unmasked for what it is, the king of pests the world over—the only one which attacks virtually all domestic plants in all climes. And it is the only one which has so high a batting average in getting its crimes blamed on other pests.

Florida Disaster

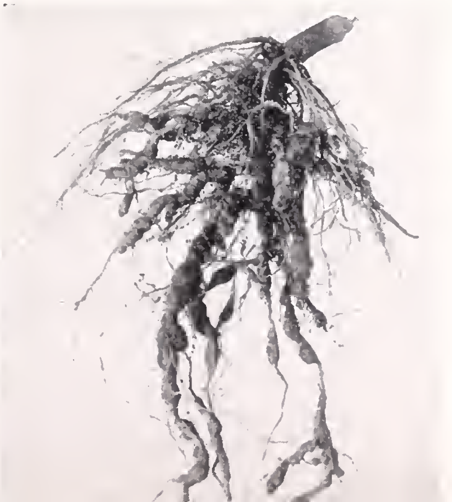
One of the smoothest deceptions ever perpetrated by a nematode was in Florida, where "spreading decline" has become a byword for disaster in a citrus grove. It took twenty-five years of scientific detective work to expose the villain in the piece. "Spreading decline" was noticed in a few trees before 1928. Then a "sick" spot became an expanding circle. The rate of the circle's growth was nearly as steady and as inexorable as the march of time.

Finally, in December, 1953, when 3000 acres of citrus trees were dead or doomed, the culprit was named. It was the burrowing nematode, a hitherto little-known variety, probably introduced by banana plants or other tropical ornamentals. It



''Whiskery'' carrots at left have been injured by nematodes; carrots at right were grown in soil where nematodes were controlled by fumigation.

Courtesy Dow Chemical Company



Masses of bunchy roots on boxwood are result of attack by meadow and rootknot nematodes.

Photos courtesy Section of Nematology, ARS, U.S.D.A.

revealed anew the confidence-man tricks of the nematode family. The burrowing nematode had so operated that suspicion for years was aimed at fungi, bacteria, and other microscopic organisms which cause rotting of roots. The microscopic life had caused the rotting, right enough, but the nematodes had opened the door for them, making the first entry into the roots and stopping the flow of nutrients.

Many Kinds

Nematodes have more ways of doing business than a Chinese trader. Many are like the burrowing nematode—it isn't that they do so much damage themselves as that they open plant rootlets to death-dealing microscopic organisms. Some are like the golden nematode of potatoes; they work boldly, and simply defy you to stop them. Some are specialists, like the citrus nematode, which go for the roots of almost nothing but citrus and olive trees. And some are like the rootknot nematode, the worst of the lot. It is at home in the roots of 1700 different plants, including many of the farmer's favorites.

Hookworms are nematodes. So are the organisms which cause trichinosis and filariasis. It's fair to say nematodes are about as big as a grain of salt, with some a little larger. But they grow four feet long in Africa.

Then there is the nematodes' seeming delicacy. They appear so fragile that a good hard look would kill them, and at some stages it just about would. They slow down when it gets cold and come to a complete stop at ten degrees above zero Fahrenheit. They die when its gets too hot. When nematodes become too numerous in California's Imperial Valley, the farmer simply turns over the earth two or three times in the summer heat and kills them by the billions. Their life span is considered to be not much more than a few weeks to a few months.

But those selfsame nematodes can be the most durable of God's creatures. The golden nematode of potatoes can live in the cyst for twenty years. The rye nematode has been revived after thirty-nine years!

A Typical Nematode

Look at a sugar-beet nematode—as a fair example of the tribe. She—most are females—starts life in a cyst that is her citadel. She doesn't leave until she gets the signal she wants. When she does venture out, she goes armed with sword and buckler and her own chemical factory. Her buckler is her skin. That's where she wears her skeleton. It is an amazingly tough material. Her sword is as fine as any steel and sharper than any blade known to man. Stiletto-shaped, it is called a stylet. Its sheath is the nematode's mouth. The stylet is an instrument so sharp and tough that it will pierce the skin of a rootlet. And in the nematode's scale of things, a rootlet's skin is a wall of rawhide as hard as an oak and nearly as thick. No other living thing of the nematode's world can pierce it.

Once the sugar-beet rootlet's skin is pierced, the nematode is in business. Like many other nematodes, she squirms all the way inside. But, unlike many others, she does not like plant nutrients as they flow in the rootlet. And so she calls on her chemical factory and gives the rootlet a shot of her home-brewed chemical. The rootlet obligingly creates what are called giant nectarial cells, her favorite food, and the nematode feasts.

She feasts so heartily that she outgrows her home, and her rear pops out. Then a peculiar thing happens. Her rear continues to swell. It exudes a jellylike mass. She lays eggs in that mass. But she isn't satisfied with laying eggs only in the jelly. She lays eggs inside her own body too. All together, she may lay only 100 or 200, but if she's really in earnest, she will lay upward of 1000. She lays eggs with such determination that soon most of her body is just one big mass of eggs.

By then her body is lemon-shaped and half the size of the head of a pin. Her head is still inside the rootlet. You can see her body with the naked eye, and with a flick of the fingernail you can decapitate her. But if no fingernail comes along, two things take place: The skin turns brown and tough, and mamma nematode

Lance nematodes attacking a rootlet. Arrow shows where one nematode's head is entering root. Greatly enlarged.

Photos courtesy Section of Nematology, ARS, U.S.D.A.

Female rootknot nematodes forming cysts in balsam root. Female at upper right has begun to deposit eggs. Greatly enlarged.

dies or perhaps it's the other way around. No one seems to care; least of all the baby nematodes that her body houses in their egg sacs. At that stage, mamma nematode's body is called a cyst. It is the young nematodes' citadel. And about the only way you can kill the little nematodes in it is to place the cyst on an anvil and strike firmly with a hammer.

The nematodes outside the cyst—those in the jelly mass—hatch as promptly as possible and go off into a world which at the time may hold only starvation and death for a growing sugar-beet nematode.

Not so those inside the cyst. They may not have minds, but they certainly know what they want. And what they want is the signal which says now is the time to come out and feast. The signal is the presence of food. Leach some water from a sugar-beet rootlet to the vicinity of a nematode's cyst, and out she pops. After that it's a happy story for her. She stabs her way into the rootlet, injects her chemical and starts contentedly to produce a new crop of nematodes.

What happens to the plant is, curiously, a frantic kind of combat. When a plant finds that a rootlet is being tapped, it sends out another. That is good news to young nematodes. They leap to the call of food and attack the new rootlet. The plant counters with still another rootlet. The nematodes send out new battalions of young. Soon the plant has a mass of rootlets which looks like a hermit's whiskers—just as many and just as untidy. Such plants have lackluster leaves. Many are stunted. Many more die. The grower may get as little as a 10% crop.

Ever since man first scratched the earth and planted a seed he has been battling and befriending the nematode. Until lately he has been much more of a friend than an enemy. He carries her wherever she wants to go, be it a few feet or a few thousand miles. He carries her to a new county or a new country in the small bits of dirt which are found in seed. He carries her in the pots of soil in which seedlings travel across countries and continents and oceans. And once she gets into a piece of soil, man carries her about the land in a dozen different ways. The plow that tills the soil spreads the nematodes along the furrows. The farmer's boots do a fair job of spreading them. Even irrigation canals are suspect as carriers.

The progress of nematodes in row crops can be watched. The plants at the focal point of infestation are stunted or dead. Year by year the area of destruction grows. It spreads up and down the furrows and from row to row. Sometimes it takes ten or a dozen years to capture a field. Occasionally there is the appearance of capture in a year or two. But any time nematode infestation appears, it's a safe bet that nematodes have been there for several years—often a dozen or more.

In tree crops and vineyards, nematodes apparently don't show their muscles for twenty or thirty years. The nematode is a worm with patience. It never seems in a hurry to take over a field or an orchard. It is in a hurry only after it has taken over. Then sometimes the speed of destruction is appalling.

Golden Nematode

That is why such a storm worked up over the invasion of Long Island by the golden nematode of potatoes. That nematode perhaps is feared the most of all. It can destroy 90 per cent of a potato crop.

The golden nematode was found in 115 acres of potatoes on two farms near Hicksville in 1941. Five years later it was in 1656 acres on forty-one Long Island farms. In 1954 it was 12,506 acres and 266 farms.

The worm made that kind of progress despite the most expensive and intensive antinematode campaign ever waged. The state of New York and the United States Department of Agriculture spent $5,700,000 in a joint effort, starting in 1944. They are still spending at a $500,000-a-year clip.

They've had laws passed rigidly governing Long Island's $100,000,000 potato industry, requiring handlers and farmers to maintain almost hospital standards of sterilization of potatoes and equipment. They've surveyed twenty-two Eastern states for the golden nematode, making tens of thousands of tests of soils. They've made thousands of inspections of soil products at entry ports and border stations—with a special eye on Mexican imports, for Mexico has the golden nematode. The fight against the golden nematode of potatoes is, thus far, a successful Chinese-wall type of operation—an attempt to hold the enemy off.

War on Nematodes

The big offensive war on other nematodes is just getting started. The two big weapons are the old stand-by, crop rotation and the new versions of an old technique, soil fumigation. But first a glance at some of the skirmishes. Some are a bit on the weird side. Some are growing in significance.

Scientists are encouraging fungi which dine off nematodes. They are watching cannibal nematodes—of which there are many—to determine how they can encourage their cannibalism. They've found that mites devour bulb-and-stem nematodes of flowers. Those all are interesting operations, but none seems to have made much of a dent in the nematode populations.

A more sober look is being given the development of systemic poisons which work on plants somewhat as antibiotics work on humans; the plant is fed chemicals which kill nematodes in the roots without harming the plants.

Then there are the outsmarting tricks. In Kern County, California, which brags about its production of potatoes, the grower simply beats the root-knot nematode to the potato. In normal years he harvests by June tenth. He has learned that by June fifteenth the second generation of nematodes—which does the big damage—is there.

Another trick is the trap crop. Root-knot nematodes, which dote on cotton, also have a fair fondness for alfalfa, a legume. *Crotalaria spectabilis*, a cover crop, is a legume. If you plant *Crotalaria spectabilis* where root-knot nematodes are, the nematodes go for its roots like kids for free ice cream. The catch is this: The nematodes pierce the *Crotalaria* rootlet, inject their chemical and feast. And that's all that happens. They don't grow. And they don't lay eggs. French marigolds have about the same effect in your garden.

Everyone knows how crop rotation works. It works well, except for two things. One is that sometimes the nematode—especially the root-knot species—takes to the substitute as a cat takes to milk. The other is that rotation often is like substituting copper for gold. The substitute—as in the case of sugar beets—may be a thirty-dollar crop instead of the $300 crop it replaces.

Soil Fumigation

Soil fumigants, while seventy-five years old in principle, are relatively new in the field. Sometimes they work like magic. They have been known to multiply cotton production by ten, sweet potatoes by seventeen, and other garden crops by nearly as much. They have restored to use marginal and abandoned land.

The new soil fumigants began to sell in 1945 after chemical concerns over the years had tested hundreds of substances. There are three leaders. They are dichloropropene-dichloropropane called DD mixture, and made by Shell Chemical Corporation; and ethylene dibromide, known as EDB, and methyl bromide, both made by Dow Chemical Company. Methyl bromide is a gas, deadly to humans. It is applied to the soil under a plastic cover. It is used mainly for seedbeds and in greenhouses.

DD and EDB are heavy, volatile liquids. They are injected six or eight inches into the soil, days or weeks before planting. Both have had sensational successes in row crops in sandy loams. They are less effective in heavier soils. They have one fault. They not only kill nematodes and other pests in the soil; they also kill roots. They spell murder to an orchard or vineyard.

Shell this spring announced that it will market this year a chemical which will kill nematodes without killing roots of established plants. Stauffer Chemical Company announced one too.

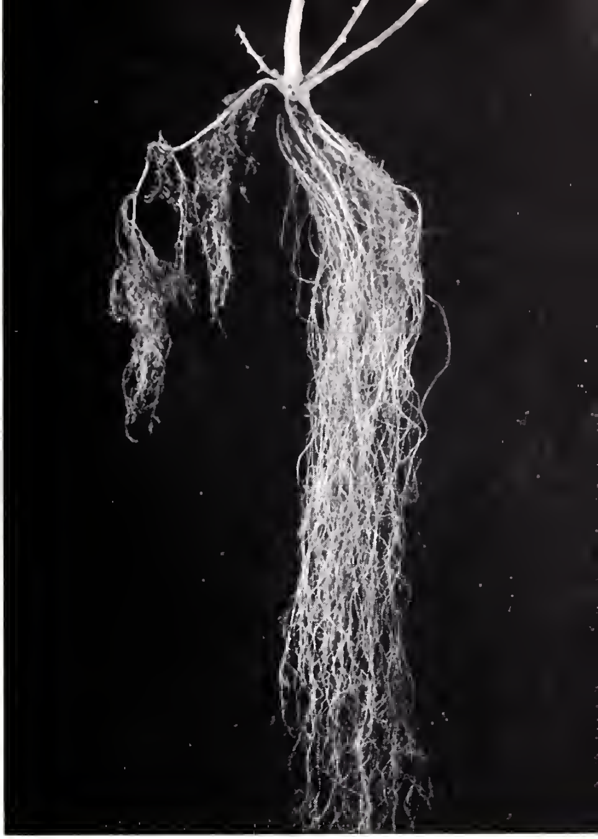


Photo courtesy Section of Nematology, ARS, U.S.D.A.

This cutting was placed astraddle two pots, one with clean soil, one with soil infested with rootknot nematodes. After 6 months roots were photographed. Infected roots on left, clean roots on right.

Dr. Gotthold Steiner, principal nematologist for the USDA, says, in substance, that soil fumigation is the answer to the nematologist's prayers. But he insists it does not solve the basic problem. He says the big need is for research.

There are many unsolved mysteries about nematodes. Why, for instance, can alfalfa be used as a rotation crop to control some nematodes which dearly love alfalfa?

Why can some plants sustain mass attacks of nematodes without apparent serious damage? What makes *Crotalaria spectabilis* a trap crop?

Someday the answers to those and hundreds of other questions about nematodes will be found.

Roche

Viola tricolor growing between flagstones.

A FEW PERFECT PEARLS FOR YOUR PAVING

Tracking down a few flawless treasures, perfect in form and appropriate for your terrace or path, is great fun and one of the most rewarding projects in gardening

Jean Lawson

Reprinted from *House Beautiful,* May, 1955

Plants don't belong in every paving, of course. There are times when even a slight bit of greenery might confuse the carefully conceived design of the landscape architect. Plants could make a small terrace smaller still. Where furniture must be moved about or where traffic is heavy, they are a problem. For a hard-worked children's terrace they are a vain hope.

But at the edge of a terrace where people seldom walk, or by the side of a permanent bench where you can enjoy them as you relax, or in scattered groups over a very large terrace, the right plants can be a source of real delight.

Pursuit of those few perfect plants for *your* paving revolves around their esthetic potentialities and their cultural requirements. Finding a handful of plants that will *look right* and *do right* in the place you need them is a good way to mature as a gardener. To beginning gardeners such attention to a detail may seem extravagant. But they have not developed the calculating, critical eye. They have yet to know the exquisite pleasure of the calculated effect, of mounting every plant to look its best, like a jeweler studying a gem to set it dramatically.

To find those perfect little pearls means travel—to the nearest well-stocked nursery or garden center, to perennial and rock garden specialists, through cultivated gardens and rock-strewn gorges, dusty old book stores and dimly lit libraries.

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Gottsho-Schleisner

Selected plants of silene and alyssum, from seeds tucked in cracks, bloom at terrace edge in garden of the George Robertses. Mary Deputy Cattell, landscape architect.

Questions to Think About

When considering a plant for your paving ask yourself: Is it appropriate? Why does it do so well where it is? Can I duplicate the conditions in my terrace? What about sun, shade, soil, and moisture? Does it have a long taproot demanding deep soil or is it shallow-rooted?

What is its ultimate size and habit? Will it keep the close, compact growth, perfect rosette of basal leaves, or other characteristic that attracted me to it originally? Will it stay in place or quickly take over the entire terrace with seedlings or spreading roots? Is it so vigorous as to force apart the paving? Is it better than a similar plant I already have? Is it worth a try?

You may be surprised at what succeeds in your terrace. Temperamental perennials usually delegated to flower borders may show greater vigor and live longer in paving where sun and air reach them from all sides. Plants which tend to sulk through soggy winters or succumb entirely to rot may flourish in the better drainage of a terrace site. Plants normally associated with warmer climates may do well in the paving of a sun pocket. Perhaps you can coax early bulbs like snowdrops and crocus into still earlier bloom in crevices between heat-absorbing stones.

As you look at new plant material let your imagination run free in exploring its potentialities. Then use every bit of discrimination you can muster to select only the very best plants for your paving.

Choose Low Growing Plants

To be practical in pavings, plants must be low and restrained in growth. Otherwise, your terrace will look like a meadow by midsummer. There may be times when you'll want to use taller plants but in most cases 4 inches is a generous maximum height. Under 2 inches is ideal.

Keep in mind that while plants like coral bells and the saxifrages may have flower stalks 2 feet high, the plants themselves are branchless rosettes of leaves clutched tightly to the roots. When they are blooming you'll be glad to move slowly among them; the rest of the time they present no traffic problem at all.

Always keep in mind the character of the surrounding garden as you plant your paving. Remember the one is part of the other. Incongruous or clashing combinations of flower, foliage, form, or scale can ruin the entire picture. Use only a few kinds of plants to avoid a jumbled patchwork-quilt look. And decide before you start whether you are striving for the stylized effect of symmetrical plants set in precisely the right places or the casual flowing elegance of the creeping kinds.

Many plants grown in rock or wall gardens are good possibilities for pavings. Paving, however, gets hotter in summer than would the same stone laid up in a wall where it partially shades itself. The soil in its joints is drier and warmer. Some plants like this; others don't.

Soil and Moisture

You can modify soil in the planting pockets to suit a particular plant, but it is rather hard to keep it moist if sun hits the terrace much of the day. So count out particularly thirsty prospects unless they also like shade and you have some to offer them. Trees overhead and shelter from prevailing winds both modify the terrace climate. Learn what you have before trying it on plants.

When properly installed, a terrace dries quickly. The underlayer base for drainage purposes can be sand, cinders or gravel. Where the ground is well settled and frost is no problem, paving may be laid directly on leveled soil. In any of these situations, planting is no problem. Just dig up enough of the drainage material between the pieces of paving so that you can fill the joints where plants will be with at least 4 inches of good soil.

Where paving is laid with mortar, planting holes must either be left or made later if the base is not concrete.

Planting

To get plant roots down into crevices without damage it may be necessary to loosen the soil around the root ball a bit (as you are careful *not* to do in regular transplanting). Then carefully work the roots down into the joint; fill in partially with soil and water carefully. Then firm the remaining soil in place. Water again; then wait several days. If the sun is warm, shade the plants with cartons or baskets until they seem settled and able to meet life on their own terms.

Where joints are very tight, as they so often are in today's terraces, it may be necessary to chip away corners to make room for plants.

Annuals can be started easily by drifting pinches of seeds into the joints, covering them with soil and watering. The roots will strike deep and spread out under the paving. As the plants develop you can pull out weaklings, leaving only a handful of good plants. Once started, some annuals re-seed themselves year after year.

Because there are many plants for many different pavings, the following lists can be no more than a group of suggestions which will start you thinking about the possibilities for your own terrace or path. Then you can do what every good gardener does—experiment with the "maybe's" while relying on the "infallibles" for your soil and climate. You'll have fun and learn much about plants as you do so.

You Can Walk (Lightly) on These

Chamomile (*Anthemis nobilis*)
Corsican mint (*Mentha requieni*)
Hippocrepis comosa
Sandworts (*Arenaria montana, A. verna caespitosa*)
Thrift (*Arenaria maritima, A. juniperifolia*)
Thymes (*Thymus vulgaris, T. serpyllum, T. lanuginosus, T. herba-barona, T. azoricus*)
Turfing daisy (*Matricaria tchihatchewi*)

Spring Flowers of Note

Alyssum
Anemone pulsatilla
Arabis
Aster alpinus
Aubrietia
Bulbs: *Narcissus bulbocodium, Iris cristata*
Coral Bells (*Heuchera*)
Creeping buttercup (*Ranunculus repens*)
Dianthus
Draba olympica
Lewisia
Persian candytuft (*Aethionema*)
Phlox subulata
Primroses (*Primula*)
Saxifrages (*Saxifraga*)
Veronica rupestris
Wallflower (*Cheiranthus*)

For Summer Color

Bellflower (*Campanula carpatica, C. garganica, C. persicifolia*)
Dryas
Gaillardia
Golden drops (*Onosma*)
Mountain bluet (*Centaurea montana*)
Potentilla nitida
Prostrate scabiosus (*Pterocephalus*)
Sun rose (*Helianthemum*)
Annuals or perennials used as annuals: abronia, African daisy, ageratum MIDGET BLUE, anagallis, annual pinks, California poppy, candytuft LITTLE PRINCE, dwarf calliopsis, English daisy, gaillardia, gazania, Iceland poppy, Mexican zinnia, nicotiana DAYLIGHT, nierembergia, portulaca, salpiglossis, silene, sweet alyssum LITTLE GEM, verbena.

Striking Foliage

Edelweiss (*Leontopodium*)
Lambs ears (*Stachys lanata*)
Common mullein (*Verbascum*)
Saxifrages (*Saxifraga*)
Sedum and *Sempervivum*
Yucca gloriosa, Y. recurva, Y. flaccida

For Shady Corners

Creeping buttercup (*Ranunculus repens*)
Erinus alpinus
Hart's tongue fern (*Phyllitis scolopendrium*)
Lobelia erinus
Mossy saxifrages
Polypody ferns (*Polypodium*)
Primroses (*Primula*)
Sweet woodruff (*Asperula odorata*)

Thymus serpyllum and wooly *Agrostemma* provide contrasting textures in this pavement planting.

Roche

WORTH READING

A SELECTED LIST OF RECENT NONTECHNICAL BOOKS, MAGAZINE ARTICLES, AND EXPERIMENT STATION BULLETINS

General

AN INTRODUCTION TO NATURE, by John Kieran. Published by Hanover House, New York, 1955. 223 pages, $6.00.

Three of this well-known writer's books on birds, flowers, and trees combined into one attractive volume.

THE NATURE OF LIVING THINGS, by C. Brooke Worth and Robert K. Enders. Published by New American Library, New York, 1955. 198 pages, 35c.

Popularly written survey of biology in pocket book form. Includes a useful glossary of biological terms.

OUTDOOR HAZARDS, REAL AND FANCIED, by Mary V. Hood. Published by Macmillan, New York, 1955. 242 pages, $3.95.

Very complete descriptions and appraisals of every sort of outdoor hazard. All nature lovers and gardeners will enjoy and profit from reading it, and it should be required reading for the superstitious.

FIELD BOOK OF AMERICAN WILD FLOWERS, by F. Schuyler Mathews, revised and edited by Norman Taylor. Published by G. P. Putnam's Sons, New York, 1955. 601 pages, $5.00.

One of the most useful and popular guides to wild flowers of Eastern and Central North America brought up to date. Numerous helpful line drawings.

GARDEN SPICE AND WILD POT-HERBS, by Walter C. Muenscher and Myron A. Rice. Published by Cornell University Press, Ithaca, New York, 1955. 211 pages, $5.75.

Accurate botanical information about wild and cultivated herbs clearly and simply presented, with directions for growing, harvesting, and use. Superbly illustrated with woodcuts by Elfriede Abbe.

THE STORY OF MOSSES, FERNS, AND MUSHROOMS, by Dorothy Sterling. Published by Doubleday, New York, 1955. 159 pages, $2.75.

The story of the flowerless plants told for young readers, but of interest even to adults. Many excellent photographs.

THE PLANTS WE EAT, by Millicent E. Selsam. Published by Morrow, New York, 1955. 123 pages, $2.50.

Authoritative information about food plants of the world, entertainingly written for young readers. Numerous drawings.

CLIMATES IN MINIATURE, by T. Bedford Franklin. Published by Philosophical Library, New York, 1955. 137 pages, $3.75.

Interesting discussion of microclimates and how farmers, gardeners, and home owners can take advantage of them.

Gardening and Horticultural Practices

THE HANDY BOOK OF GARDENING, by Albert E. Wilkinson and Victor A. Tiedjens. Published by New American Library, 1955. 206 pages, 35c.

Pocket book edition of well-known book covering all phases of gardening.

PRACTICAL GARDENING, by Olive Mason Gunnison. Published by Doubleday, New York, 1955. 384 pages, $4.50.

Clear, precise, down-to-earth directions for all gardening activities. Numerous helpful drawings and diagrams.

THE HOME GARDENING ENCYCLOPEDIA, edited by W. H. Lewis. Published by Philosophical Library, New York, 1955. 368 pages, $6.00.

New revised edition of English encyclopedia containing information on all aspects of gardening and garden plants with special emphasis on how-to-do-it. 31 charts, 32 pages of photographs.

A TREASURY OF AMERICAN GARDENING, edited by John Whiting. Published by Doubleday, New York, 1955. 272 pages, $7.50.

A handsome volume of contributions on many gardening topics by top authorities. Beautifully illustrated.

HOUSE AND GARDEN'S NEW COMPLETE BOOK OF GARDENS, by the editors of *House and Garden*. Published by Simon and Schuster, New York, 1955. 320 pages, $10.00.

A garden guide that is also a treasure-trove of beautiful horticultural photographs, many in full color. Covers all aspects of gardening, indoors and out.

ORGANIC GARDENING, by J. I. Rodale. Published by Hanover House, New York, 1955. 224 pages, $3.95.

For those interested, here is a clear and thorough exposition of the beliefs and practices of the organic gardening school.

GROWING PLANTS UNDER ARTIFICIAL LIGHT, by Peggie Schulz. Published by M. Barrows, New York, 1955. 146 pages, $3.50.

Complete details for the home gardener on this very promising development in horticulture.

HOW TO HAVE A GREEN THUMB WITHOUT AN ACHING BACK, by Ruth Stout. Published by Exposition Press, New York, 1955. 164 pages, $2.75.

How one gardener has solved her problems by extensive use of mulches, entertainingly and pithily told.

NEW GREENHOUSE GARDENING FOR EVERYONE, by Ernest Chabot. Published by M. Barrows, New York, 1955. 252 pages, $4.75.

Complete manual for setting up and maintaining the home greenhouse.

SOIL WARMING BY ELECTRICITY, by R. H. Coombes. Published by Philosophical Library, New York, 1955. 116 pages, $4.75.

Information on installation of soil warming equipment for greenhouses, cold-frames, and cloches.

FROST PROTECTION WITH SPRINKLER IRRIGATION, by John R. Davis. Michigan State College (Lansing, Michigan) Extension Bulletin 327, April, 1955. 12 pages.

Explains principle and practice of this new and interesting technique.

Trees and Shrubs

SHRUBS AND TREES FOR THE SMALL PLACE, by P. J. Van Melle. Published by Doubleday, New York, 1955. 246 pages, $3.00.

New edition of a well-known and authoritative book completely revised and edited by Montague Free. Fully illustrated.

WOODY PLANTS FOR LANDSCAPE USE, by L. J. Enright. Published by College Science Publishers, State College, Pennsylvania, 1955. 127 pages, spiral, $2.70.

Woody plants grouped and classified in many ways to enable the gardener to make selections for any given situation and purpose.

CRAB APPLES FOR AMERICA, by Donald Wyman. Published by American Association of Botanical Gardens and Arboretums, Philadelphia, Pennsylvania, 1955. 63 pages, $2.00.

Revised edition of this useful book. Gives order of bloom, flower and fruit characters, and much other information about practically all horticultural forms of crab apples.

HOW TO GROW ROSES, by John Paul Edwards and the staff of *Sunset* magazine. Published by Lane, Menlo Park, California, 1955. 88 pages, $1.50.

Basic procedure and latest developments in rose growing, illustrated with many drawings and with photographs in black and white and in color.

CLIMBING ROSES, by Helen Van Pelt Wilson. Published by M. Barrows, New York, 1955. 212 pages, $3.95.

The first book in 20 years devoted entirely to climbers. Complete discussion of care and culture, where to use climbers. Many photographs and 16 pages of how-to-do drawings.

ASIATIC MAGNOLIAS IN CULTIVATION, by G. H. Johnstone. Published by the Royal Horticultural Society, London, 1955. 155 pages, approximately $9.00.

A magnificent volume by an author with extensive first-hand experience with these beautiful flowering trees. Covers botany, culture, and propagation. 14 exquisite color plates and numerous illustrations in black and white.

CAMELLIAS IN AMERICA, by H. Harold Hume. Published by J. Horace McFarland, Harrisburg, Pennsylvania, revised, 1955. 568 pages, $25.50.

The second edition of this valuable book by a dean of American horticulture covers all the material appearing in the first edition plus new developments in species and varieties, pest and disease control, etc. 65 full color and many black and white illustrations.

SHRUBS FOR THE ROCK GARDEN AND ALPINE HOUSE, by Royton E. Heath. Published by W. H. and L. Collinridge, Ltd., London, England, 1954. Agent in United States, Transatlantic Arts, Hollywood-by-the-Sea, Florida. 191 pages, $10.00.

Valuable book for the fancier of alpines. Divided into two parts, the first dealing with culture, the second with descriptions of the plants. 16 pages of photographs.

BONSAI, compiled and published by Sanseido, Tokyo, Japan, 1954. 172 pages, approximately $3.25.

Despite the fact that the text is in Japanese, bonsai enthusiasts will find much of delight and inspiration in this book because of its more than 116 pages of pictures of fine examples of bonsai grown by fanciers all over Japan.

BONSAI—MINIATURE TREES, by Claude Chidamian. Published by Van Nostrand, Princeton, New Jersey, 1955. 96 pages, $3.95.

A clearly-written book setting forth the essentials of bonsai culture and some of the philosophy behind it. The 14 photographs illustrating various types of bonsai were selected from among the nearly 100 to be found in the Brooklyn Botanic Garden's *Handbook on Bonsai.* 10 pages of drawings.

GARDEN HEDGES — NEW AND RENEWED, by Richard E. Pride and Alfred W. Boicourt. University of Massachusetts (Amherst, Massachusetts) Extension Leaflet Number 280, March, 1955. 4 pages.

Selecting, planting, and caring for the plants more commonly used for hedges.

AZALEA CULTURE, by R. J. Wilmot and R. D. Dickey. University of Florida Agricultural Experiment Stations (Gainesville, Florida) Bulletin 659, June, 1955. 4 pages.

Culture, propagation, and pest control for Kurume and Indian azaleas grown in warm climates.

MINOR FRUITS, by George L. Slate. In *National Horticultural Magazine,* July, 1955. 11 pages.

Description and culture of useful but little-known native and exotic fruits which may well be worth consideration by home gardeners.

Annuals and Perennials

ALL ABOUT THE PERENNIAL GARDEN, by Montague Free. Published by Doubleday, New York, 1955. 352 pages, $5.95.

Every detail of planning and planting a perennial garden discussed step-by-step by a well-known, outstanding horticulturist. Many drawings and photographs.

THE COMPLETE BOOK OF ANNUALS, by F. F. Rockwell and Esther C. Grayson. Published by Doubleday, New York, 1955. 315 pages, $5.95.

Complete descriptions of all commonly grown annuals, their culture, and how to get the most out of them. Profusely illustrated with drawings and photographs.

PRIMROSES AND POLYANTHUS, by Roy Genders and H. C. Taylor. Published by Criterion Books, New York, 1954. 143 pages, $3.00.

Descriptions, culture, and history of two increasingly popular groups of garden flowers.

GERANIUMS FOR HOME AND GARDEN, by Helen K. Krauss. Published by Macmillan, New York, 1955. 194 pages, $5.00.

Describes nearly 1000 kinds of geraniums and gives thorough instructions for their culture. 16 pages of photographs, 1 color plate.

GROW CACTI, by C. Marsden. Published by Cleaver-Hume Press, Ltd., London, England, 1955. Agent in United States, Abbey Garden Press, Pasadena, California. 176 pages, $2.25.

The first of a series on cacti, this book deals with all aspects of cactus culture, indoors and out.

TREE PEONIES, in *National Horticultural Magazine,* January, 1955. 61 pages.

An entire issue of the magazine devoted to the history, culture, and propagation of tree peonies. Valuable lists of collections in public and private gardens, dealers, and available varieties.

DAYLILIES, by Robert Baker Wynne. In *Flower Grower,* July, 1955. 8 pages.

Listings and descriptions of daylilies (*Hemerocallis*) of many kinds for many purposes. Includes directions for planting and care.

PERENNIALS, by Montague Free and Marjorie P. Johnson. In *Flower Grower,* March, 1955. 12 pages.

Three groups of articles answering practically all questions most commonly asked concerning perennials and the perennial garden.

Weeds, Pests, and Diseases

WEEDS, by W. C. Muenscher. Published by Macmillan, New York, 1955. 560 pages, $10.00.

Second edition, revised and expanded, of this definitive work on recognition and control of weeds. 135 plates illustrate over 300 varieties of weeds.

CROP PROTECTION, by G. J. Rose. Published by Philosophical Library, New York, 1955. 223 pages, $10.00.

Thorough discussion of materials and methods of using modern insecticides and weed killers. Intended primarily for large-scale growers, it contains information valuable to any gardener.

CHEMICAL CONTROL OF WEEDS AND BRUSH, by W. O. Scott and F. W. Slife. University of Illinois College of Agriculture (Urbana, Illinois) Extension Service Circular 742, May, 1955. 12 pages.

Covers types of herbicides, control of weeds in crops, control of specific weeds.

SPRAYS FOR HOME FRUIT PLANTINGS. Cooperative Extension Work in Agriculture and Home Economics, University of Kentucky (Lexington, Kentucky) Circular 521 (revised), April, 1955. 12 pages.

How to control pests by sanitation, whether to use dusts or sprays, spray schedules for various fruits.

APHIDS AND SCALE INSECTS ON ORNAMENTALS, by John C. Schread. Connecticut Agricultural Experiment Station (New Haven, Connecticut) Bulletin 588, February, 1955. 22 pages.

Descriptions of aphid and scale pests of several common woody and herbaceous ornamentals; recommended methods of control.

MITE PESTS OF ORNAMENTALS AND THEIR CONTROL, by John C. Schread. Connecticut Agricultural Experiment Station (New Haven, Connecticut) Bulletin 591, March, 1955. 19 pages.

Experimental evaluation of various control measures; recommendations for control.

PESTS AND DISEASES OF TREES AND SHRUBS. Wisconsin State Department of Agriculture (Madison, Wisconsin) Bulletin 330. May-June, 1955. 88 pages.

Useful handbook containing accurate descriptions of diseases and pests of important woody plants growing in Wisconsin.

INSECT PESTS OF EVERGREENS, by G. S. Gesell. Pennsylvania State University College of Agriculture (University Park, Pennsylvania) Circular 449, 1955. 21 pages.

Descriptions and control of pests of 13 common ornamental evergreens.

DISEASES AND INSECT PESTS OF RHODODENDRON AND AZALEA, by Spencer H. Davis, Jr., and C. C. Hamilton. New Jersey Agricultural Experiment Station (New Brunswick, New Jersey) Circular 571, June, 1955. 30 pages.

Gives detailed directions for recognizing and treating most of the common diseases and pests of these valuable ornamentals.

THE JAPANESE BEETLE AND ITS CONTROL, by J. O. Pepper and S. G. Gesell. Pennsylvania State University College of Agriculture (University Park, Pennsylvania) Circular 451, 1955. 9 pages.

Insecticides to use, other methods of control, control of grubs in turf and soil. Also see U.S.D.A. Farmer's Bulletin 2004, revised, *Controlling the Japanese Beetle.*

Landscaping and Lawns

GARDEN DESIGN ILLUSTRATED, by John A. Grant and Carol L. Grant. Published by University of Washington Press, Seattle, Washington. 157 pages, $5.75.

Authoritative and well-written guide to garden design. Many superb photographs and an abundance of useful, easy-to-follow plans and diagrams.

LANDSCAPING YOUR OWN HOME, by Alice L. Dustan. Published by Macmillan, New York, 1955. 248 pages, $3.95.

Step-by-step discussion of home landscaping from initial survey of property to consideration of seasonal color in plantings. Numerous photographs.

HOW TO INSTALL AND CARE FOR YOUR LAWN. Published by Lane, Menlo Park, California, 1955. 64 pages, $1.00.

Complete directions for establishing and maintaining a lawn. Many diagrams and pictures.

Breeding and Propagation

METHODS OF PLANT BREEDING, by Hayes, Immer, and Smith. Published by McGraw-Hill, New York, 1955. 551 pages, $8.50.

A valuable and complete text book for commercial plant breeders which interested amateurs will also find helpful and enlightening, though somewhat technical.

PLANT PROPAGATION PRACTICES, by James S. Wells. Published by Macmillan, New York, 1955. 334 pages, $7.50.

Primarily for the nurseryman or large-scale grower, this text of plant propagation contains information of interest to home gardeners as well. Detailed procedures for handling 18 basic nursery plants are given.

ROOTING HOLLY CUTTINGS IN A WINDOW BOX, by Roger W. Pease. West Virginia University Experiment Station (Morgantown, West Virginia) Circular 97, June, 1955. 20 pages.

Detailed directions for preparing cuttings, treating them, growth media to use, care of cuttings, and construction of propagating boxes.

MIST PROPAGATION, by Jasper N. Joiner and T. J. Sheehan. Agricultural Extension Service (Gainesville, Florida) Circular 127, February, 1955. 4 pages.

Use of mist by both commercial and home growers, placement of beds, rooting media, timing, types of cuttings.

House Plants and Flower Arrangement

INDOOR PLANTS AND HOW TO GROW THEM, by A. Bertrand. Published by the Philosophical Press, New York, 1955. 92 pages, $4.75.

Following a brief general section devoted to care of houseplants, individual cultural directions are given for some 100 different kinds. 36 black and white and 20 colored illustrations.

CREATIVE FLOWER ARRANGING, by Margaret Carrick. Published by M. Barrows, New York, 1955. 192 pages, $4.50.

Beautifully illustrated with many photographs, this book presents a new and exciting approach to flower arranging.

FLOWER ARRANGEMENT WORKBOOK 3, by Myra J. Brooks. Published by M. Barrows, New York, 1955. 64 pages, $2.50 (spiral binding, $2.00).

Another in a series of fine books for students of flower arranging, presenting still more advanced problems and solutions than are found in the first two.

FLOWER SHOW KNOW-HOW, by William Thomas Wood, and Marie Stevens Wood. Published by Merriewoode Press, Macon, Georgia, 1954. 71 pages, paper $1.00, cloth $2.75.

Handy guide to staging and conducting a flower show.

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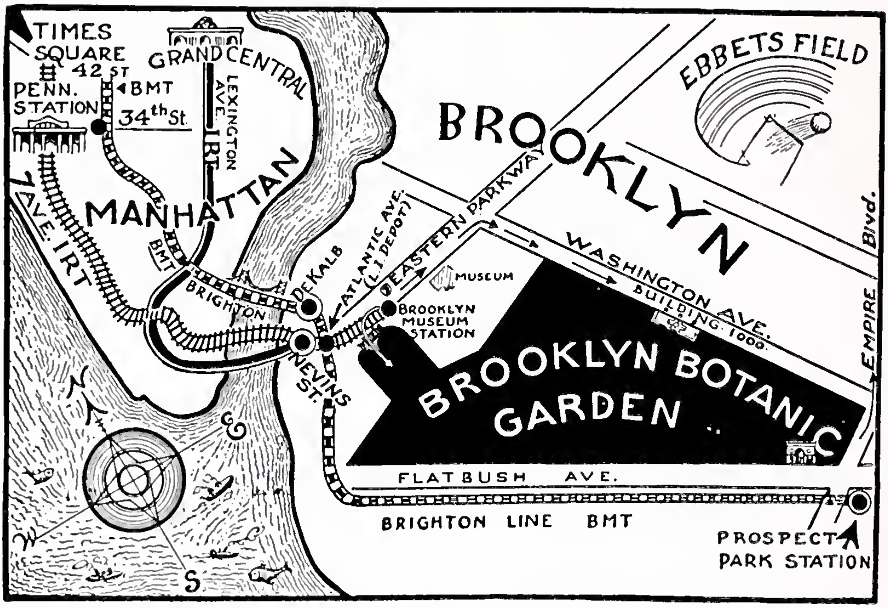
CORRECTION

Flower arrangement "Lilies and Bamboo" in cover photograph, Autumn number, should be credited to Rae L. Goldson (with apologies to Mrs. Goldson).



TO REACH THE GARDEN

By Subway

B.M.T. (Brighton Beach line) downtown express or local to Prospect Park Station.

I.R.T., West Side (7th Avenue or Broadway-7th Avenue line) downtown express marked "New Lots Avenue" or "Flatbush Avenue," to Eastern Parkway-Brooklyn Museum Station.

I.R.T., East Side (Lexington Avenue line) downtown express marked "New Lots Avenue" or "Utica Avenue" or "Atlantic Avenue," to Nevins Street; step across platform and change to 7th Avenue or Broadway-7th Avenue train, ride to Eastern Parkway-Brooklyn Museum Station.

By Bus

Flatbush Avenue bus to Empire Boulevard
Lorimer Street bus } To Flatbush Avenue
Tompkins Avenue bus }

Union Street bus } To Prospect Park Plaza
Vanderbilt Avenue bus }

By Automobile

From Long Island, take Eastern Parkway westward, and turn left at Washington Avenue.

From Manhattan, take Manhattan Bridge, follow Flatbush Avenue Extension and Flatbush Avenue to Eastern Parkway; follow the Parkway to Washington Avenue, then turn right.